* NOTICES *

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2.**** shows the word which can not be translated.
3.In the drawings, any words are not translated.

CLAIMS

[Claim(s)]
1. Flow of Fluid -- Warming -- Assembly for Putting on Heat Contact Condition with Equipment -- it is -- this -- Warming -- Equipment It has the heated mandril of ** length which has the outside surface of the almost smooth truncated-cone configuration which specifies a center shaft. This mandril The slot on radial is specified in the lower part of this mandril, and it is this assembly. : It is the outside limit object fitted so that it might be attached in a part of [at least] surroundings of the die length of this mandril in sliding. This limit object has two edges and internal surfaces, and this internal surface specifies a major axis. The boundary of the path for the flow of the fluid with which this internal surface of this mandril and the outside surface of this mandril pass along this assembly is formed. A slot and this limit object radial [this] form the boundary of the inlet-port manifold section of this path. The outside limit object with which this inlet-port manifold is located near one edge of this assembly; it reaches. The 1st means for drawing the flow in the inlet port of a fluid along with this inlet-port manifold in the inside of this inlet-port manifold Assembly which it had.
2. Include Inlet Port, Outlet, and Two Side Attachment Walls that Paste Up Mutually, and Form Said Path and Seal. It is an assembly containing a bag for sterilization according to claim 1, and this bag is attached in said limit object, and is arranged almost along with said internal surface. This internal surface When this limit object is arranged around said mandril, and a fluid flows through this path, this internal surface and this outside surface of this mandril The assembly currently fabricated so that the almost uniform gap of this side attachment wall may be supported without binding tight in the direction of a major axis covering a part of die length [at least] of this path in accordance with this mandril, and forming a point in it.
3. It is Assembly Containing Bag for Sterilization Including Inlet Port, Outlet, and Two Side Attachment Walls According to Claim 1. The path where this side attachment wall of each other was pasted up, and it was sealed from this inlet port for a fluid to this outlet is formed. This bag is an assembly mostly arranged in this internal surface so that it may be attached in said outside limit object, this inlet port may be located near the end of this limit object and this outlet may be located near the other end of this limit object.
4. assembly according to claim 3 currently fabricate so that this limit object be arrange for said internal surface of said limit object around said mandril , and almost uniform gap of said side attachment wall may be maintain , without this internal surface and this outside surface of this mandril bind tight covering the great portion of die length of said path , and form point if fluid flow from said inlet port to said outlet .
5. Assembly according to claim 1 with which said limit object migrates to said the greater part of surface field of said mandril, and fluid is fabricated so that it may flow in sheet-like configuration where it is not mostly blocked in said path from said inlet-port manifold along with die length of this mandril.
6. Assembly according to claim 1 constituted so that said means which the 1st draws may draw mostly inflow of blood to said inlet-port manifold perpendicularly to major axis which is tangential direction and is specified with this mandril to said outside surface of said mandril.
7. Assembly according to claim 1 with which said means which the 1st draws contains bracket attached in said limit object.
8. Assembly according to claim 1 said whose internal surface is configuration of truncated cone mostly.
9. Assembly according to claim 1 constituted so that said assembly may have consistency on said mandril and may arrange this assembly to desired relative position.
10. Equipment according to claim 1 with which said assembly includes the means for having consistency on said mandril and securing a desired relative position attached in said limit object.
11. The assembly according to claim 1 with which said limit object contains rigid shell.
12. The assembly according to claim 1 constituted [if said assembly is arranged to this mandril in a desired location,] so that said assembly and said outside surface of said mandril may form the sheet-like

configuration where the flow of a fluid is not mostly blocked over most surface fields of this mandril when a fluid flows through said path, and this path may be formed.
13. The assembly according to claim 12 said whose path is almost fixed thickness.
14. the assembly according to claim 1 constituted so that said limit object may form the mating standoff of said inlet port of said path, and said outlet arranged mostly in near, and this mating standoff may be adjusted on said mandril, and this path may become the thickness of about 1 law around this mandril in a hoop direction, and this limit object may be arranged in the location of a desired include angle to this mandril.
15. The assembly according to claim 1 with which said mandril specifies a 2nd radial slot, said limit object and slot on radial specify the boundary of the outlet manifold section of said path, and said assembly includes the 2nd means for drawing the flow of the fluid from this outlet manifold in this outlet manifold and the direction which aligns mostly.
16. Equipment according to claim 15 with which said assembly includes the flexible side attachment wall which forms the wall for said path.
17. Equipment according to claim 16 with which said assembly contains the bag which forms said path in the state of seal.
18. Said limit object is an assembly according to claim 16 which is rigid shell.
19. The assembly according to claim 15 constituted so that said means which the 2nd draws may draw runoff of the blood from said outlet manifold perpendicularly mostly to the major axis which is a tangential direction and is specified with this mandril to said outside surface of said mandril.
20. Flow of Fluid -- Warming -- Assembly for Putting on Equipment and Heat Contact Condition -- it is -- this -- Warming -- Equipment It has the heated mandril of ** length which has the outside surface of the almost smooth truncated-cone configuration which specifies a center shaft. This mandril A 2nd radial slot is specified in the lower part of this mandril in a 1st radial slot and the upper part of this mandril. This assembly: It is the outside limit object fitted so that it might be attached in a part of [at least] surroundings of the die length of this mandril in sliding. This limit object has two edges and internal surfaces, and this internal surface specifies a major axis. The boundary of the path for the flow of the fluid with which this internal surface and the outside surface of this mandril pass along this assembly is formed. A slot and a limit object 1st radial [this] form the boundary of the inlet-port manifold section of this path. outside limit object; which this inlet-port manifold has near the end of this assembly -- and -- the flow in the inlet port of a fluid -- the inside of this inlet-port manifold -- and the 1st means for leading along with this inlet-port manifold -- having --; -- and -- This limit object and a 2nd radial slot specify the boundary of the outlet manifold section of this path. And the assembly equipped with the 2nd means for drawing the flow of the fluid from this outlet manifold in this outlet manifold and the direction which aligns mostly.

[Translation done.]

DETAILED DESCRIPTION

[Detailed Description of the Invention]
blood -- warming -- equipment Background of invention this invention -- general -- a fluid -- warming -- some equipments are formed and it is related with the assembly which offers the path where it was sealed for the flow of the fluid which passes along equipment. It is related with such an assembly for the equipment which warms a fluid outside an intestinal tract like whole blood in more detail under the temperature conditions by which it was controlled for blood-transfusion treatment etc.
Generally, since the quality of blood is saved over a long period of time, whole blood is kept under refrigeration conditions with a temperature of about 4 degrees C. When pouring blood into a patient, it is required to warm blood at about 37 degrees C which is human being's temperature, and to avoid the risk of contraction of possibility of causing the shape of a hypothermy, the ventricular fibrillation accompanying this, and the heart. on the other hand, warming -- if the temperature of blood is raised too much in a process, deterioration will be solidified or carried out and blood will be obtained.
In much surgical management, in order to use it during treatment, blood volume to be warmed may be changed sharply. Since it cannot restrict that all the warmed blood is used, consequently the recooling warehouse of the blood generally cannot be carried out when warming sufficient blood volume to all the conditions of being predicted, the blood of an excess becomes useless. Moreover, time amount required to warm a lot of blood for blood transfusion in the case of the victim of accident or other emergency can become a serious factor.
In order to heat a lot of blood, blood may be warmed when flowing into a patient from a storage assembly. However, the required rate of flow changes with many surgical conditions and procedures. The rate of flow of blood may actually be substantially changed also in the same surgical management. For example, if a patient bleeds suddenly during treatment, the blood style to a patient must be increased rapidly. If bleeding stops, a blood style may be reduced rapidly.
Therefore, it is desirable to be able for the rate of flow to warm a fluid like the blood changed substantially controllable, and to send a patient a fluid at the temperature of an almost fixed request. furthermore, the case where upper limit temperature is in a fluid -- a fluid -- overheating -- and it should heat, without carrying out deterioration.
Furthermore, it is desirable to offer the equipment which has the control system which actuation does not become complicated too much and can heat a fluid to accuracy to desired outlet temperature.
Moreover, it is desirable to offer the equipment for warming the fluid which incorporated the safety practice for preventing too much warming by the malfunction of a control system. furthermore, warming of a fluid -- it should be made for an operator and other participating staff to understand inner temperature easily furthermore, the blood which simplifies all setting out and actuation management at the time of a device activity, and reduces the possibility of misuse -- warming -- it is desirable to offer a device.
since there is risk of a disease being infected by pouring in a contamination fluid into the body -- what kind of fluid -- warming -- it is dramatically important also for a vessel not to make a fluid pollute. blood -- warming -- the vessel has incorporated an assembly like the disposable element containing a disposable tube or a bag in many cases. such an element -- a fluid -- warming -- when flowing through a vessel, a fluid is held thoroughly.
the disposable element of arbitration -- warming -- it is desirable for an activity with the element of a vessel which "is not throwing away" to be easy. moreover, warming in which the disposable element carried out the outline to the above -- the case where it is one element of a vessel -- an element -- warming -- it must be possible to operate the rate of flow changed without degrading the engine performance of a vessel.
Furthermore, the disposable element of arbitration should make priming capacity small, in order to reduce

futility.
Therefore, one object of this invention is offering the improved device or equipment for fluid warming. Especially the object relevant to this is offering the improved device it is made to have a cold fluid outside an intestinal tract like the whole blood for using it during a surgery procedure warmed.
the fluid with which it was improved for the further object of this invention to warm blood and other fluids outside an intestinal tract to the temperature of about 1 law over the wide range rate of flow -- warming -- it is offering a device.
the improved fluid with which another object of this invention has convenient actuation with a fluid, and an operator's amount of managements can be managed with the minimum -- warming -- it is offering a device.
the improved fluid for which still more nearly another object of this invention needs only the minimum setup time -- warming -- it is offering a device. Furthermore, as for setting out, it is desirable efficient and to be carried out to insurance.
still more nearly another object of this invention -- warming -- the improved fluid whose element of the device which contacts a fluid into a process is throwing away -- warming -- it is offering a device.
warming by which the above was improved -- it is also the object of this invention to offer the disposable element constituted so that it may unite with the operational characteristic of the element which is not throwing away of a device. warming by which, as for the object relevant to this, the above was improved -- it is offering such a disposable element that may be adapted for the rate of flow reached far and wide and changed, without degrading the operational characteristic of a device.
Offering a disposable element with a small priming capacity is also the object of this invention which it becomes still more. The object relevant to this is making it easy to attach a disposable element in the element which is not throwing away for it to be right and possible [actuation].
Summary of invention Therefore, the assembly which forms some equipments for warming the flow of a fluid is offered. Equipment reaches far and wide or warms a fluid controllable to the rate of flow to change. The assembly of throwing away of equipment is preferably adapted for this rate of flow to change.
Equipment includes the heating base which has the mandril which specifies a shaft, and with which ** length was heated mostly. A part of outside surface [at least] of a mandril is formed with an ingredient with high thermal conductivity, and it considers as a configuration which receives an assembly in sliding, and, as for a mandril, this mainly heats flowing fluid by conduction through an assembly. Conduction contact is mainly performed between a mandril and an assembly.
An assembly includes an outside limit object. A bag is attached in a limit object and it is arranged along with the internal surface of a limit object. A bag has an inlet port and an outlet and each is attached in a communication trunk. Including the side attachment wall of a couple each other pasted up preferably, a bag forms a sheet-like seal path so that a fluid may flow between an inlet port and outlets. If an assembly is arranged around a mandril, a sheet-like path will extend around the circumferential front face of a mandril substantially.
An assembly and a mandril carry out alignment (register) of the assembly to a mandril, and they are constituted so that the path which passes along a bag by this may be formed with a desired configuration. In more detail, a side attachment wall is bundled up and suppressed by the internal surface of an outside limit object, and the outside surface of a mandril, and the flow of the shape of a sheet by which a desired configuration is not restricted between an inlet port and an outlet is established. A fluid is warmed controllable, when flowing through a path.
Furthermore, an assembly and a mandril are constituted so that a desired velocity distribution may be formed along the front face of a mandril. A desired velocity distribution interacts with the heat distribution which met on the surface of the mandril, and it promotes heating of a fluid so that there may be no local hot spot where the temperature of a fluid can exceed an upper limit.
Equipment contains the system which controls the heat input to the fluid which is flowing again. A fluid can be warmed to desired outlet temperature, without a control system's fluctuating heat input depending on the input from a temperature sensor, and overheating any parts of a fluid. Preferably, a control system can amend the rate of flow which controls heat input and is changed again.
easy explanation of a drawing the fluid with which drawing 1 includes the assembly of this invention -- warming --; which is the fluoroscopy exploded view into which the components of one suitable operation gestalt of equipment were made to divide
drawing 1 a -- the fluid of drawing 1 -- warming --; which is the perspective drawing of the clamp which forms some equipments
drawing 2 -- the fluid of drawing 1 -- warming --; which is the sectional side elevation of equipment

drawing 3 -- the fluid of drawing 1 -- warming --; which is the expanded sectional view of the mating-standoff section of the assembly which forms some equipments
Drawing 4 is the functional block diagram of the electric system which forms some equipments of drawing 1 .;
drawing 5 -- the fluid of drawing 1 -- warming --; which is the front view of the control panel of equipment ; which drawing 6 is the top view of the cuff which forms some equipments of drawing 1 , and is shown in the opened location -- and -- Drawing 7 is the elevation angle front view of the assembly which forms some equipments of drawing 1 and which can be attached.
explanation of a suitable embodiment drawing 1 -- referring to -- especially -- warming of blood -- a fluid including the assembly of this invention constituted by the ** -- warming -- 10 shows one suitable embodiment of a vessel as a whole. warming -- a vessel 10 warms flowing fluid controllable through the seal passage formed by the assembly or assembly (14 shows as a whole) by which the heating unit was attached including the heating unit shown by 12 as a whole. an assembly -- desirable -- throwing away -- and it is dismountable. The heating unit 12 has the heating core 16, and a heating core is connected to the base 18 which contains some control systems 20 shown in drawing 4 in graph.
Also referring to drawing 2 , the heating core 16 has the mandril 24 with which thermal conductivity, such as aluminum, consists of a high ingredient. Heat is supplied to a mandril 24 by the heater 26 which is formed as a sheet and carries out conduction contact with the internal surface 28 of a mandril. An internal surface 28 is constituted so that the cylindrical cavernous section 30 which is prolonged in the height of a mandril 24 and specifies a shaft 34 preferably may be formed.
the height of the cavernous section boils a heater a part of at least preferably [the greater part of], and it goes over it, and it is prolonged.
The outside surface 36 of a mandril 24 is formed so that it may become easy to cover the surroundings of a mandril and to arrange the disposable assembly 14 dismountable. arranging an assembly 14 appropriately to a mandril 24 so that it may mention later -- warming -- it is important in order to obtain the optimum performance of equipment 10. The outside surface 36 and assembly 14 of a mandril 24 are formed so that it may become a truncated-cone configuration complementary. Preferably, a front face 36 is constituted so that dip may be slightly formed to a vertical center line 43.
Assembly which can be attached An assembly 14 contains the outside limit object 40, an inside bag, or a cuff 44. An inside bag forms the seal path 46 (drawing 6) which has a sheet-like configuration mostly, while the fluid is flowing through equipment 10. a path 46 -- a fluid -- warming -- when flowing through equipment 10, it is important that the thermal output of the heating unit 12 makes all the fluids a peculiar configuration so that it may warm to desired temperature, without exceeding upper limit temperature.
warming -- about this suitable operation gestalt of equipment 10, it is dramatically desirable to form in the surroundings of a heating core the flow of the shape of a sheet which has the thickness of about 1 law.
Therefore, it is important to position between the disposable element 14 and mandrils 24 correctly relatively.

When the limit object leans to the mandril 24, the thickness of some parts of a path 46 becomes thin too much, and there is a possibility that flow may be restrained and it may be slow-speed-ized. Similarly, with the mandril of a path, when the thickness of the part of an opposite hand becomes thick too much, there is a possibility that flow may become quick too much.
Therefore, when the boundary 47 for a path 46 is established and a fluid flows the limit object 40 and a mandril 24 through a path by this, it is desirable to be constituted so that a path may have the clearance or thickness 48 of homogeneity and may be formed in the surroundings of most surface fields of a mandril 24.
With the desirable configuration of one specification, a path 46 is formed so that it may have the thickness of homogeneity covering the great portion of die length of a path in accordance with a mandril 24 outside.
The internal surface 50 of the limit object 40 forms outside boundary 46a, and reflects the configuration of an outside surface 36. if it is appropriately positioned so that an outside surface 36 may form inside boundary 47b and the disposable assembly 14 may be juxtaposed by the mandril 24, the die length of a path will be preferably [at least / a part of / the greater part of] alike, and an outside surface 36 and an internal surface 50 will cross, and will form the path 46 of the thickness of homogeneity.
With this suitable operation gestalt, the path 46 with a thickness of about 0.2 inches is established, and a good result is obtained with the thickness of such a path. other thickness -- warming -- it is thought that sufficient result to operate within the parameter of a request of equipment 10 is obtained.
In order to make easy an effort required to position an assembly 14 appropriately, regardless of about the relative method of an angle of an assembly and a mandril, it is suitable to attach an assembly 14 in the

surroundings of a mandril 24. Furthermore, it is desirable for an assembly to rotate to a mandril 24. Therefore, it aligns so that the horizontal cross section of the internal surface 50 of the limit object 40 and the outside surface 36 of a mandril 24 may become a concentric circle mutually almost circularly, and the core of the cross section of these versatility specifies a shaft 52 covering the great portion of die length of a mandril 24. Preferably, in order to make manufacture easy, a shaft 52 and a shaft 34 are on the same straight line.

With reference to drawing 6 and drawing 7 , a cuff 44 contains the sheet 54 of two sheets. These sheets are arranged at juxtaposition and form the side attachment wall 57 for the seal sheet-like path 46 for the flow of the fluid which pastes up in the state of seal mutually around the circumference edge 56, and passes along admission passage. or [putting a cuff 44 on the relation as for which the horizontal side edge 58 contacted in line] -- or it is constituted and is folded up in the shape of a curve so that it may be arranged and a truncated-cone configuration may be formed. Thereby, a cuff is inserted into the limit object 40 and it becomes possible to cover smoothly a part of internal surface [at least] 50 of the limit object 40. A cuff 44 meets the substantial part of the height of the limit object 40, and is [desirable] completely [smoothly and] a wrap about an internal surface 50 (drawing 2).

If an application-of-pressure fluid flows through a cuff 44 with reference to drawing 2 and drawing 6 , a fluid will push a sheet 54 to the limit object 40 and a mandril 24, and a path 46 will serve as a configuration of a boundary 47. A series of mating standofves 60 (drawing 3) are formed, and the limit object 40 is extended inside from a limit object, in order to make it align and to form in the perimeter of a mandril alignment and the path 46 which has the clearance 48 between homogeneity in the shape of a periphery in accordance with a mandril 24 to a mandril 24. A mating standoff 60 contacts the outside surface 36 of a mandril 24, and supports an assembly to a mandril in a desired location.

As shown especially in drawing 7 , the turbulence of the flow of the shape of "bolting" and a sheet of the path 46 by the mating standoff 60 is the minimum. desirable -- a mandril 24 -- meeting -- the die length of the outside path 46 -- it goes more desirably over a part at least more than one half, and the thickness of the path 46 in a cuff 44 is uniform in the shape of a periphery around a mandril. Moreover, the substantial part of the die length of a path 46 and the obstruction [bolting / preferably / an obstruction / over most] are not in the boundary front face on which a mandril and the limit object 40 counter. Therefore, flowing fluid flows in a sheet-like configuration mostly over most outside-surface fields of a mandril 24 through a path 46.

With this suitable operation gestalt, a cuff 44 is prolonged on a mating standoff 60. Contact of a mating standoff 60 and a mandril 24 expects that a cuff 44 may be damaged. Therefore, a cuff 44 forms a mating standoff 60 and the reinforcement hollow 64 which aligns. A hollow 64 is formed so that a path 46 may not explode, even if wear or punching of a cuff 44 is generated in the part of a hollow.

A hollow 64 is formed by setting and fusing a sheet 54 and forming a protection seal in the surroundings of a point of contact with a mating standoff 60 preferably.

It is important for the limit object 40 that a cuff 44 can be supported so that the thickness of a path may not be substantially changed by flowing fluid in a path 46 under the pressure to change and the rate-of-flow conditions. Furthermore, the limit object 40 must protect a cuff 44. Therefore, with this suitable operation gestalt, the limit object 40 is the desirable rigid lightweight shell 66. Moreover, in order to reduce a storage space, things are also taken into consideration making it shell 66 be bending and flexibility which becomes empty. It is also considered that one side of the side attachment wall of a cuff 44 can form the limit object 40.

Flowing fluid is led to a path 46 so that the surroundings of the base 68 of a mandril 24 may be flowed first and then the inside of a sheet configuration may be flowed upward to the upper bed 70 of a mandril along a front face 36. The inlet port 74 of a fluid is formed in the soffit section 76 of a cuff 44, and an outlet 78 is formed in the upper bed section 80.

If the mandril 24 is required, it will input heat and will warm a fluid to desired outlet temperature. Especially when a fluid has upper limit temperature, it asks for flow distribution of a fluid being almost uniform in a path and around a mandril 24. It is made for the limit object 40, a cuff 44, and a mandril 24 to have the flow of the shape of a sheet which it cooperates, and flowing fluid flows the surroundings of a mandril 24 first to a path 46, and then flows to homogeneity mostly in accordance with a mandril formed. When especially the rate of flow is high and a fluid flows into an inlet port 74 first by the width of face or clearance thickness of a path, a fluid is prevented from being first distributed over the surroundings of a mandril 24. Therefore, it is desirable to form in a path 46 the inlet-port manifold section 86 which surround a mandril 24 along with the bottom green 88 of a cuff 44. Preferably, the inlet-port manifold 86 forms both a mandril 24, or limit both [either or / these] 40, and is formed by forming the inlet-port manifold 86 with

clearance thickness larger than the thickness of the path along the interstitial segment or section 90 of a path 46.
With this suitable operation gestalt, the slot 94 on radial is formed in a mandril 24, and a base 68 is specified. And as shown especially in drawing 1 , the limit object 40 and a slot form boundary 86a of the inlet-port manifold 86. Or it can constitute so that it may have the radial ring section (not shown) prolonged outside in the limit object 40. Moreover, it is also meant that both a mandril 24 and the limit object 40 can be constituted so that boundary 86a for a manifold 86 may be formed.
By forming the outlet manifold section 98 of a path of the same reason, and forming the mandril which has the up slot 100 on radial preferably prescribes a mandril 24 around an upper bed 70. A slot 100 and the limit object 40 form boundary 98a of the outlet manifold 98. Other configurations are meant as mentioned above.
In order to collaborate with the inlet-port manifold 86, an inlet port 74 is formed so that a fluid may be led in the die-length direction of an inlet-port manifold. Similarly, an outlet 78 is formed so that the fluid which comes out from a path 46 may flow out in the outlet manifold 98 and the direction in which it aligned.
Therefore, an inlet port 74 and an outlet 78 are formed so that a tangent may be made to the front face where the shape of the limit object 40 and a curve of a mandril 24 counters, and a fluid may be led in a corresponding manifold and the direction which aligned. It is suitable for an inlet port 74 and an outlet 78 to lead a fluid in the almost vertical direction to the shaft 54 of an assembly so that I may be understood.
An inlet port 76 is connected to an inlet pipe 104, and this tubing draws the tangent of a request of the flowing fluid in nothing and the direction which aligned. The circumference edge 56 of a sheet 54 is mutually pasted up in the state of seal in the hit of tubing 104. In order to release stress, and to fix tubing 104 to the limit object 40 and to turn to this, an assembly 14 contains the bracket 106 linked to a limit object. A bracket 106 offers the path of the tubing 104 which results to a clearance 48 through the limit object 40 in the direction of desired again.
An outlet 78 is connected to the outlet manifold 98 and the outlet pipe 105 which has aligned, and flowing fluid is led to this tubing along with a manifold 98. The circumference edge 56 of a sheet 54 is mutually pasted up in the state of seal in the hit of tubing 105. In order to release stress, and to fix tubing 105 to the limit object 40 and to turn to this, an assembly 14 contains the up bracket 107 linked to a limit object. A bracket 107 offers the path of the tubing 104 which results to a clearance 48 through the limit object 40 in the direction of desired again.
A cuff 44 is a tab 102 (adjacently formed in an edge along the edge of the limit object 40).
It may be formed with a series of outside handle parts 101 which are boiled and attached and maintain a cuff in a stratified configuration along with an internal surface 50.
An assembly 14 is arranged at a mandril 24 and the force of water pressure of opposing a mandril and an assembly if an application-of-pressure fluid flows through a path 46 is applied with a sheet 54.
Since the horizontal cross section of the limit object 40 is almost circular, the force applied to a limit object is outwardness almost radially, and balance is kept equal along the perimeter of a mandril 24.
Next, the above-mentioned force is erased inside, without binding tight between the heating unit 12 and the disposable assembly 14, and needing a mechanism or a reinforcement node by the strength of the ring of the limit object 40.
Mutually, according to the force of the water pressure of an opposite direction, the side attachment wall 54 of a cuff 44 is pushed, a mandril 24 is contacted, and, thereby, good conduction contact is established between a cuff 44 and a mandril.
Moreover, in order to make easy suitable arrangement to the mandril 24 of an assembly 14, form the lower apron 108 in shell 44, and it is made to contact by adjoining the radial boss 110 of a mandril 24, and shell and a mandril are aligned perpendicularly. Although it is thought that a mating standoff 60 aligns an assembly 14 to a base 18 theoretically, when an apron 108 and a boss 110 contact by the margo inferior, it serves to prevent a user blocking a mandril 24 with an assembly carelessly.
With reference to drawing 3 and drawing 7 , a mating standoff 60 is preferably formed in the limit object 40 and one, is a wedge configuration in ** length mostly, and forms the head 114 in contact with a mandril 24. The height "h" of a mating standoff 60 is equivalent to the thickness of a request of a clearance 48 (drawing 2).
If the limit object 40 is appropriately arranged to a mandril 24, a mating standoff 60 will be selectively arranged so that a mating standoff may contact a mandril and may establish a clearance. Preferably, a mating standoff 64 aligns so that lower set 64near soffit of up set 64a and mandril near upper bed of two sets 24 which aligned horizontally, i.e., mandril, b may be formed. Preferably, along with a periphery, each sets 64a and 64b open spacing equally in include angle, and are arranged.

While an assembly 14 is locked to the heating unit 12 with reference to drawing 1 and drawing 1 a, in order still to enable removal of an assembly, a heating unit includes the clamp 116 prolonged upward from the base 18 top front face 117 of the location very near a mandril 24. A clamp 116 is adjusted with the handle part 118 prolonged on the outside formed in the soffit of the limit object 40. The disposable assembly 14 is slid on the surroundings of a mandril 24, and is arranged until the lower apron 108 contacts a boss 110 and a mating standoff 60 contacts a mandril 24, in order to lock a cup 14 to a unit 12. Next, a cup 14 is rotated until a handle part 118 locks under a clamp 116. In order to show having been locked with reference to drawing 1 a, and in order to reduce the possibility of careless lock discharge by showing resistance slightly to lock discharge, a notch 120 is formed along the underside of the up element 122 of a clamp. When an assembly 14 aligns appropriately with a base 18 and it is locked by the base, a notch 120 is constituted so that a handle part 118 may be held.

Heating unit With reference to drawing 2 and drawing 7 , working and the fluid which should be warmed flow an inlet pipe 104 upward in accordance with a passage, a cuff 44, and the heated mandril 24. A fluid is the coldest at lower 46a of a path 46, since possibility of overheating a fluid is the largest at about 78 outlet, a heater 26 is changed along with the die length of a mandril 24, and it is suitable for it to be constituted so that the declining thermal output may be generated. With reference to drawing 2 , the heating sheet 26 consists of this suitable operation gestalt so that the thermal output of the heating sheet 26 may be divided into the band 124 of five longitudinal directions. Each band is the thermal output consistency of homogeneity, and the thermal output consistencies of a band differ only in a desired rate mutually. From up longitudinal direction band l24b of an upper bed, lower longitudinal direction band 124a arranged along the soffit of a core 16 has a large output, and a thermal output becomes gradually large in the middle bands 124c-124e.

The heating sheet 26 may be constituted so that the thermal output consistency of up band 124b may be about 20% of a thermal output consistency of lower band 124a. By forming medium band l24e which has medium band 124d which has about 50% of thermal output consistency of lower medium band 124c which has about 75% of thermal output consistency of a lower band, and lower band 124a, and about 30% of thermal output consistency of a lower band showed that a good result arose. Moreover, even if it offers the heating core 16 which has other thermal output distribution, it is also expected that sufficient result may arise.

Moreover, in order to sense the temperature of a fluid with reference to drawing 4 to be it being able to control heating of a fluid, equipment 10 contains at least one and two or more desirable temperature sensing devices 130 which are arranged in the location very near the upper bed of a mandril 24. Moreover, equipment 10 contains at least one arranged in the location very near the soffit of a mandril 24, and two or more temperature sensing devices 132. Preferably, devices 130 and 132 are arranged at each edge of a mandril 24. in order to offer the good temperature sensing range and good safety -- the upper part and the lower sensing devices 130 and 132 -- both -- desirable -- the temperature sensing device according to two individuals -- containing -- each device of the pair -- the opposite hand of a mandril 24 -- that is, 180 degrees is left and it is arranged.

Moreover, it is suitable for the lower device 132 to align to the up device 130 and a perpendicular direction. In order to offer a system with insurance and dependability, the temperature sensing devices 130 and 132 are thermistors. The temperature sensing device of other types may also be used.

Control system When a fluid flows through the disposable assembly 14 (drawing 1) under the conditions on which the rate of flow is broadly changed with reference to drawing 4 , especially the control system 20 is suitable for controlling actuation of the heating core 16 so that it may heat to desired temperature at insurance, without overheating a fluid. Typically, the input to a system 20 is a signal output from the up temperature sensing devices 130a and 130b and the lower temperature sensing devices 132a and 132b. The signal output of the up temperature sensing devices 130a and 130b is amplified by Circuits 204a and 204b, respectively. Similarly, the signal output of the lower temperature sensing devices 132a and 132b is amplified by Circuits 206a and 206b.

In order to corroborate that both up temperature sensing devices 130a and 130b are functioning appropriately, one each of the output amplified from the up sensing device is supplied to the 1st comparison circuit 208. A circuit 208 determines the difference of two temperature currently sensed by sensing devices 130a and 130b. next, the determining [beforehand]-by circuit 210-this difference alarm value deltaT1 -- it is preferably compared with 10 degrees C. The difference of two temperature currently sensed by sensing devices 130a and 130b is equal to deltaT1 at least, or when larger than this, it is shown that the up temperature sensing devices 130a and 130b may be malfunctions, and the 1st alarm signal is outputted to the

OR switch 212.
In order to corroborate that both lower temperature sensing devices 132a and 132b are functioning appropriately, one each of the output amplified from the lower sensing devices 132a and 132b is supplied to the 2nd comparison circuit 216. A circuit 216 determines the difference of two temperature currently sensed by sensing devices 132a and 132b. next, the determining [beforehand]-by circuit 218-this difference alarm value deltaT2 -- it is preferably compared with 10 degrees C. The difference of two temperature currently sensed by sensing devices 132a and 132b is equal to deltaT2 at least, or when larger than this, it is shown that the lower temperature sensing devices 132a and 132b may be malfunctions, and the 2nd alarm signal is outputted to the OR switch 212.
In order to tell this when a fluid is overheated, while the fluid is flowing through the cup 14 (drawing 1) if a little drawing 1 is referred to, a control system 20 supervises the temperature of a mandril 24, if it is equal to the upper limit temperature TU1 determined beforehand at least or this is exceeded, it will emit an alarm, and intercepts the electric power supply to the superheater core 16. In detail, the 2nd magnification output from each of the up sensing devices 130a and 130b is supplied to the 3rd comparison circuit 220 where an individual exception corresponds. Each of the 3rd comparison circuit 220 measures the sensed input temperature with the upper limit temperature TU1. When one side of the 3rd comparison circuit 220 determines that the sensed input temperature is larger than the upper limit alarm temperature TU1, it is the 3rd alarm signal from this circuit.
It is outputted to the ** OR switch 212. In the case of blood etc., TU1 is desirable and the fluid currently warmed is 42 degrees.
Similarly, the 4th comparison circuit 224 according to individual to which the 2nd magnification output from each of the lower sensing devices 132a and 132b corresponds is supplied. The 4th comparison circuit 224 is compared with the alarm temperature TU2 which determined the input signal beforehand. TU2 is preferably equal to TU1. If the temperature of the higher one where one side of a circuit 224 is sensed is equal to TU2 at least or it determines to be higher than this, this circuit will output the 4th alarm signal to the OR switch 212.
Therefore, the displayed temperature which is supplied by the temperature sensing device is used for a control system 20, it determines whether one side of the up sensing devices 130a and 130b is operating unsuitably, and whether one side of the lower sensing devices 132a and 132b is operating unsuitably in the row, and it can turn out that an alarm signal will be generated if a sensing device determines that it is not operating appropriately. Moreover, when it is equal to each alarm temperature determined beforehand at least, or it determines whether sense temperature higher than this, and either of the up sensing devices 130a and 130b or either of the lower sensing devices 132a and 132b is equal to alarm temperature or exceeds this, as for a control system 20, it generates an alarm signal.
A control system 20 contains the voltage monitor circuit 230 which supervises the power currently supplied to the heating sheet 26 again, and the configuration element which constitutes a control system. A voltage monitor 230 will output the 5th alarm signal to the OR switch 212, if a failed state is determined.
If the OR switch 212 receives the 1st, 2nd, 3rd, 4th, or 5th alarm signal from a circuit 210, a circuit 218, a circuit 220, a circuit 224, or a circuit 230, respectively, a signal will be transmitted to the alarm circuit 232. One side of the alarm circuit 232 activates at least one audible alarm 234 which tells a health-care provider about being a failed state. The 2nd alarm circuit 232 can exercise the visible alarm supplied according to an operation of blinking the figure of a back light or a display panel 238. In addition to activating an alarm 234, the output from the OR switch 212 may be sent in order to activate the cutoff repeater 240 which turns OFF power currently supplied to the heating sheet 26 (drawing 2) with the heating core 16 again. With this suitable operation gestalt, the cutoff repeater 240 may be changed to ON by making a unit OFF and ON, when an alarm condition stops already existing.
Moreover, with reference to drawing 1 , it is selectively dependent on the temperature sensed by at least one of the up temperature sensing devices 130a and 130b and the lower temperature sensing devices 132a and 132b at least, and a control system 20 controls heating of a fluid possible [actuation].
Typically, the temperature of a fluid in case a fluid flows equipment 10 is the highest, when a fluid is near the upper bed 70 of a mandril 24. Therefore, it is selectively dependent on the maximum temperature sensed by the up temperature sensing devices 130a and 130b at least, and a control system 20 controls heating of a core 16 by this suitable operation gestalt. In this actuation process, the magnification output from each of the up temperature sensors 130a and 130b is supplied to the 5th comparison circuit 244. The 5th circuit 244 outputs the higher one of the two temperature inputs to the 1st arithmetic circuit 246. In case an arithmetic circuit 246 determines the electric energy of the request for a heater 26 for input temperature [the set point

temperature TSP], it equalizes the difference over the period determined beforehand. A set point temperature input is supplied by the set point circuit 252 which is set as the temperature TSP of a request of the fluid which exists in equipment 10 and which can be adjusted. Setting out of the desired temperature TSP is typically performed during manufacture.
The output from the 5th circuit 244 is also sent to a display panel 236, and is displayed on the user of equipment 10.
Preferably, in order to compensate change the rate of flow of the fluid which passes along equipment 10 has been sensed to be it, a control system 20 is constituted again so that the thermal output of the heating unit 12 may be adjusted. Such adjustment is useful when the thermal output of the heating unit 12 is controlled by temperature the fluid of the circumference of an upper bed 70 has mainly been sensed to be it. for example, warming -- equipment 10 can attain the thermal output and temperature control of a steady state to the predetermined rate of flow of a fluid. If control is not performed at all to others, even if the rate of flow changes suddenly, the thermal output of the heating unit 12 is not changed until the up sensor 130 detects change of the temperature of an upper bed 70.
For example, if the rate of flow of blood goes up suddenly while maintaining fixed heat supply, the temperature of the blood which comes out equipment 10 will fall. The thermal output of a unit 12 may increase next so that it may mention later, but even if this increment is enough for warming the blood the outlet of a cuff 44, or near it to desired temperature in time, it is not considered to be enough. Therefore, it is desirable to sense change of the rate of flow with this suitable operation gestalt in the location very near an inlet port 74 as quickly as possible.
With this suitable operation gestalt, change of the rate of flow may be detected by supervising change of the temperature of a mandril 24 in the location very near the soffit 76 of the path 46 where a fluid flows into a cuff 44 first. A thermal output with the comparatively fixed heating unit 12 is offered, and when an inflow fluid is low temperature, a substantial change of the flow of a fluid is generally reflected in change of the temperature of the soffit of the mandril 24 sensed by the lower temperature sensing devices 132a and 132b. For example, when the flow of the fluid to a path 46 increases substantially, the soffit of a mandril is cooled quite quickly generally. Therefore, the thermal output of the heating core 16 should be made to increase. If the flow of the fluid to a path 46 falls reversely substantially, the soffit of a mandril 24 will be heated quite quickly generally. Therefore, the thermal output of the heating core 16 should be decreased.
The output from each of the lower temperature sensor which amplifies a circuit 224 is supplied to the 6th comparison circuit 248. The output from the 6th comparison circuit 248 expresses the temperature of the higher one currently sensed by the lower temperature sensing devices 132a and 132b, and is supplied to the differential circuit 250 which generates the 2nd input to the operation comparison circuit 246. It is selectively dependent on the rate of change of the temperature currently sensed by lower temperature sensing device 1gl(s) 32a and 132b at least, and the 2nd input generated by the differential circuit 250 is changed.
An arithmetic circuit 246 adds together the input from the power decision based on a differential circuit 250 and the average difference between the temperature and the set point temperature TSP which have been sensed, and outputs a signal to the power equalization circuit 254. Preferably, although the power equalization circuit 254 is a pulse width modulator etc., other suitable equalization circuits are meant. The output from the power equalization circuit 254 is supplied as the 1st input to junction 256.
The fluid which mainly flows out of equipment 10 overheats a control system 20 again, and the safety practice prevented [that the alarm circuit 232 is activated as a result and] is included. A safety practice includes the process which intercepts the power to the heating core 16, when any one of the up temperature sensing devices 130a and 130b and the lower temperature sensing devices 132a and 132b has sensed the trigger temperature TT. Trigger temperature is preferably between the set point temperature TSP and the alarm temperature TU1 and TU2. With this suitable operation gestalt, the trigger temperature TT is set up so that it may become equal to set point temperature TSP plus 1 degree C with a control system 20. If the sensed temperature becomes lower than the trigger temperature TT, power will be supplied again. The output from the 3rd comparison circuit 244 which is the one where the temperature sensed by the up temperature sensing devices 130a and 130b is higher is supplied to the 1st set point comparison circuit [the trigger temperature TT / temperature / this] 258.
Temperature is equal to the trigger temperature TT at least, or when exceeding this, the output which shows this is supplied to junction 256 as the 2nd input.
The output from the 6th comparison circuit 248 which similarly shows the higher one of the temperature sensed by the lower temperature sensing devices 132a and 132b is supplied to the 2nd set point comparison

circuit [the 2nd trigger temperature TT 2 / temperature / this] 262. The 2nd trigger temperature is preferably the same as the 1st trigger temperature (but it is possible that such trigger temperature may be changed). The shown temperature is equal to the 2nd trigger temperature at least, or when exceeding this, the output which shows this is supplied to junction 256 as the 3rd input.
the 1st input to which junction 254 is supplied by the power equalization circuit 254 when junction 256 does not receive the output from the 1st set point comparison circuit 258, or the output from the 2nd set point indicator circuit 262 -- a switching circuit 264 -- it transmits to a zero crossover stationary repeater etc. preferably. The power currently supplied to the heater 26 is controlled selectively, sufficient heat is outputted by the heater by this, and a switching circuit 264 is warmed to the outlet temperature or set point temperature of a request of flowing fluid through equipment.
However, the output from either of the set point comparison circuits 258 and 262 has priority over an output from the power adjusted power 254, and, for this reason, a switching circuit 264 intercepts the power to a heater 26. If the maximum temperature sensed becomes lower than both trigger temperature TT1 and TT2, control of the power equalization circuit 254 will be recovered.
this suitable operation gestalt -- warming -- although the control logic of a vessel 10 is attained by using the new configuration of a circuit element, other methods of controlling the output of a heater 26 and heating a fluid controllable are meant. It conceives also of realizing control by using a microprocessor and suitable programming. Such programming may be arranged in the combination of volatile or non-volatile memory or the memory of varieties. furthermore, a fluid which stores a part of program in a different memory unit, makes these some dismountable, and programs by remote operation, or is different sake -- warming -- you may enable it to constitute the operational characteristic of a vessel 10 easily
Control panel With reference to drawing 1 and drawing 2 , a base 18 is mostly formed in a cubical configuration. The front face 122 of a base 18 forms the view opening 140 which can see a display 238. The latch door 142 forms a part of base 18, and it is attached in a front face 140 by the hinge. If you make it connected with drawing 4 and drawing 5 is referred to, the latch door 142 will offer covering for protection of a control panel shown with a reference number 144 as a whole. A control panel 144 offers an easy means for an engineer to perform the trial about the control system 20 of equipment 10. The button switch 146 which performs the trial for the up temperature sensors 130a and 130b and the lower temperature sensors 132a and 132b is contained in a control panel. In relation to a button switch 146, the switch 148 of two or more test conditions from which one is chosen selectively is arranged. By pushing one of button switches 146, the failed state simulated by each temperature sensing device is generated, and, as a result, the alarm circuit 232 is started (that is, it will be in an alarm condition). Furthermore, it is shown that the light 150 lit up and the button switch 146 was pushed.
It depends for a specific test condition on the location of a switch 148. In the 1st location, by pushing one of button switches 146, failure of a sensor is simulated, the alarm circuit 232 is activated by this, and the cutoff repeater 240 is activated. The cutoff repeater 240 may be reset by the reset switch 154. If a reset switch 154 is pushed, the related LED indicator light 156 will light up, and a repeater 240 will be reset, and an indicator light 150 will be switched off.
Conditions may be simulated whenever [hyperthermia] by pushing one of switches 146 by setting a switch 148 as the 2nd location using a potentiometer 158. An engineer should just look at a display 238, adjusting a potentiometer. And when the control system 20 is working appropriately, if the temperature shown in a display exceeds alarm temperature, the alarm circuit 232 will be activated. A cutoff repeater is activated and an indicator light 150 lights up. A push on a reset switch 154 resets a circuit.
Furthermore, a control system 20 includes the means 160 for determining whether the display 238 is proofread appropriately. In detail, the means for corroborating the calibration of a display 238 is the reference voltage circuit 161 which has the related light 162 and which was determined beforehand. A temperature set point calibration means contains the set point circuit 152 which can be adjusted, and the related light 164 again.
warming -- in order to set equipment 10 as the suitable mode for either a normal actuation and display calibration or temperature set point adjustment, 3 location rotary switch 166 is used preferably. In order to perform one of these trials, a mode selector switch 166 is rotated to a suitable location, and an engineer looks at the temperature shown in the display. Lights 162 or 164 are turned on also in order to show which trial is performed. When the display calibration trial is performed, the display should show the temperature corresponding to the test voltage determined beforehand. For example, since test voltage can respond to 50 degrees C, the display should show the temperature, when functioning appropriately. When the set point trial is performed, the display should show the temperature of a set point. In the 3rd location of a switch 166,

the heating unit 12 is put on a normal system operation, and turns neither of indicator lights 152 and 154 on any longer.
A control panel 144 includes the switch 174 for examining the circuit which adjusts a thermal output depending on the rate of change of the switch 168 relevant to the trial of a control circuit and the lower sensor light 170 again. By pushing either of these switches 168 and 174, the corresponding light 176 is also turned on, and the alarm circuit 232 is activated, and the cutoff repeater 240 is intercepted. By pushing a reset switch 154, an alarm 232 and the cutoff repeater 240 are reset, and the turned-on light 176 may be switched off.
That is, various alarm conditions and vision displays may be checked by the engineer by using a test switch. If each trial is performed, a corresponding display light will light up. Therefore, if all trials are completed and a circuit is reset appropriately, all lights will put out the light.
If a trial is completed, a door 142 will be closed and it will prevent that it is locked and the user behind equipment 10 contacts. As an aid for acquiring suitable actuation of equipment 10 certainly, a next user is limited to an on-off switch 179 (drawing 1). When "nuisance" alarm conditions occur in a next activity, a control system 20 may be reset by turning OFF equipment 10 with an on-off switch 179, and then returning to ON. After such actuation is considered that it is shown that equipment 10 is a malfunction when an alarm display continues.
It returns to drawing 1 , and the base 18 in this suitable operation gestalt contains the friction fit electrode holder 180 for holding the bubble trap (not shown) usually used again, while having medicated the patient with blood etc. Equipment 10 includes the covering 182 inserted in the circumference of the head of the heating core 16 for environmental protection again.
About installing, equipment 10 includes the clamp 184 attached in the base 18. A clamp binds equipment tight to a rod 186. A clamp 180 makes equipment 10 dismountable easily from a rod 186 again. Although a rod 186 is usually arranged perpendicularly, equipment can operate in any directions by the operational characteristic of equipment 10.
In the case of actuation, an assembly 14 is inserted in the surroundings of a mandril 24 in sliding until a mating standoff 60 contacts the outside surface 36 of a mandril 24. By contact between a mating standoff 60 and an outside surface 36, the limit object 40 is set by the core of a front face 36, and the path 46 which has a uniform clearance or thickness 48 (drawing 2) between a limit object and a front face over most surface fields of a front face 36 is established. Moreover, the larger space between the limit objects 40 and mandrils 24 in the slot 94 radial [lower] and the slot 100 on upside forms boundary 86a of the inlet-port manifold section 86 of a path, and boundary 98a of the outlet manifold section 98.
The lower apron 108 of the limit object 40 contacts the boss 110 of a mandril. Next, an assembly 14 is rotated to the heating unit 12 until a handle part 118 is inserted in the bottom of the notch 120 (drawing 1 a) formed in the clamp 116 with ****.
Next, when a fluid flows through an inlet pipe 104, it flows into a cuff 44. the time of a fluid going into a cuff 44, as for tubing 104 -- a fluid -- the front face 36 of a mandril 24 -- receiving -- the direction of a tangent -- and a fluid is led so that it may be led along with the die length of a manifold 86. If a fluid flows into a path 46, air will be driven out of a path and the priming of the equipment 10 will be carried out.
When a fluid goes into a path 46 first, a fluid fills the inlet-port manifold 86 which specifies the periphery of a mandril 24. Next, a fluid serves as sheet-like flow and flows along with the die length of a mandril 24.
Next, a fluid is heated, while becoming the vertical flow by which about 1 direction is not regulated upward at the circumference of the heating core 16 and flowing. If equipment 10 is activated, a control system 20 (drawing 4) controls the heat input to the fluid which is flowing, and before a fluid flows out of a path 46 by this, it will warm it to the temperature of a request of a fluid.
While pushing the paries medialis orbitae 57 of the flank sheet 54 toward a mandril 24 with the pressure of a fluid, the radial force of the sense, and this and the force of pushing the paries lateralis orbitae 57 of the sheet 54 which reacts toward the limit object 40 and of radial [outward] are formed. The outward force is uniformly distributed along with the periphery of the limit object 40, and main doubling of the limit object on a mandril 24 is promoted, and a clearance 48 and a path 46 have almost fixed thickness in the circumference of the heating core 16. When a path 46 is fixed thickness, equal heating of a fluid is promoted and formation of a hot spot is prevented. Moreover, the heat transition to a fluid is promoted by pushing the interior of the flank sheet 54 toward the heating core 16.
Next, the heated fluid is brought together in the outlet manifold 98, aligns with the die-length direction of a manifold, and is mostly left from a manifold through an outlet pipe 105 to the front face 36 of a mandril 24 in a tangential direction.

A bubble trap may be attached in a clamp 180 when the up tubing 80 is connected to the administration set containing a bubble trap (not shown).
medical aid -- warming -- if it reaches when blood is not needed any longer, an assembly 14 will be rotated to the heating unit 12 until the heating unit 12 separates from the lower part of the notch 120 by which it was intercepted, next the handle part 118 was formed in the clamp 116. Next, an assembly 14 is removed from a mandril 24 in sliding above, and it can dispose by the suitable approach.
the description about the above-mentioned actuation can show -- as -- warming -- setting out and actuation of equipment 10 are quite simple, and there are few amounts of managements of actuation. Generally, setting out includes inserting in the disposable assembly 14 with ****** in sliding on the heating unit 12. An assembly 10 is activated by pushing an on-off switch 179. Management includes observing an alarm and supervising display temperature.
blood -- warming -- although the specific operation gestalt of equipment was illustrated and described, it may be understood by this contractor that modification and an alteration may be performed without deviating from this invention as the broad aspect of affairs is shown in the following claims.

[Translation done.]

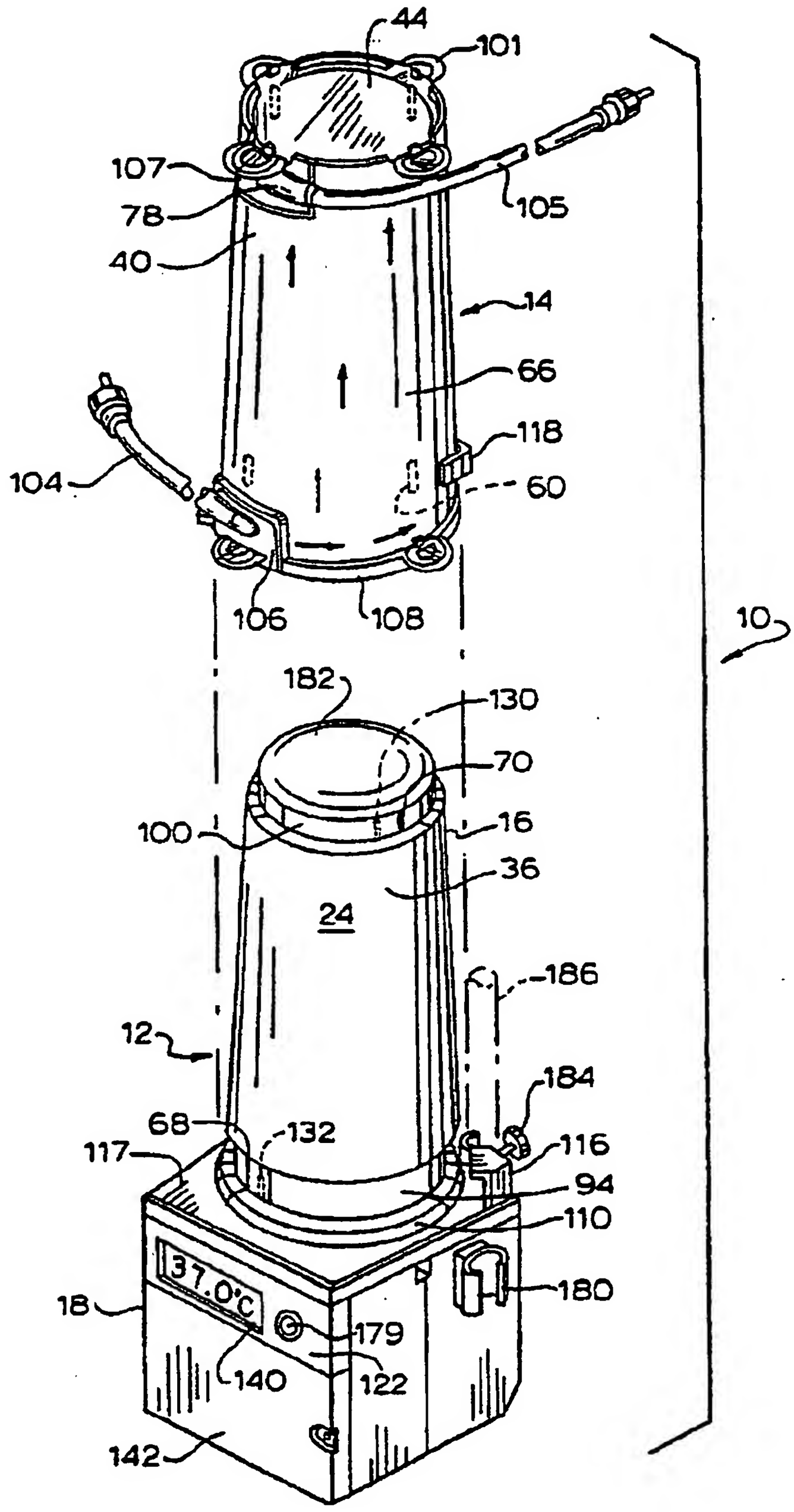
* NOTICES *

1.This document has been translated by computer. So the translation may not reflect the original precisely.
2.**** shows the word which can not be translated.
3.In the drawings, any words are not translated.

DRAWINGS

[Drawing 1]

FIG.1



[Drawing 1]

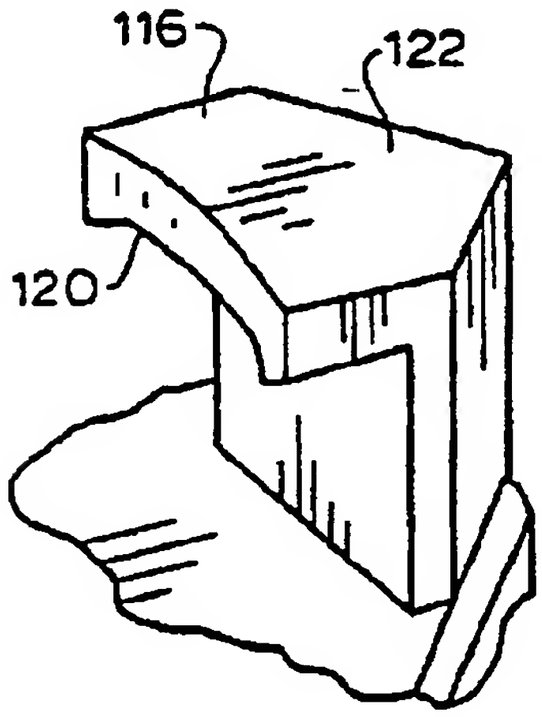
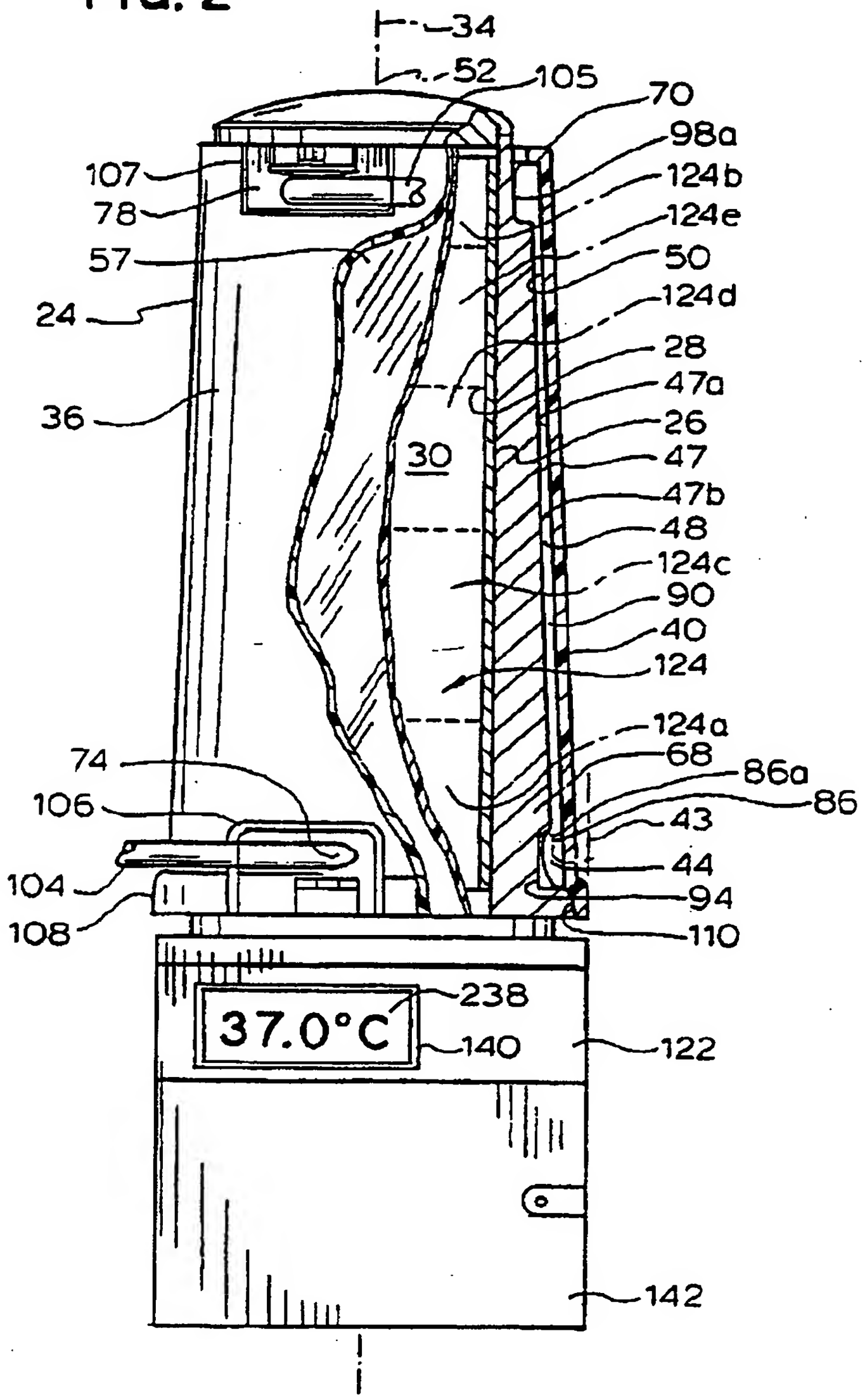


FIG. 1a

[Drawing 2]

FIG. 2



[Drawing 3]

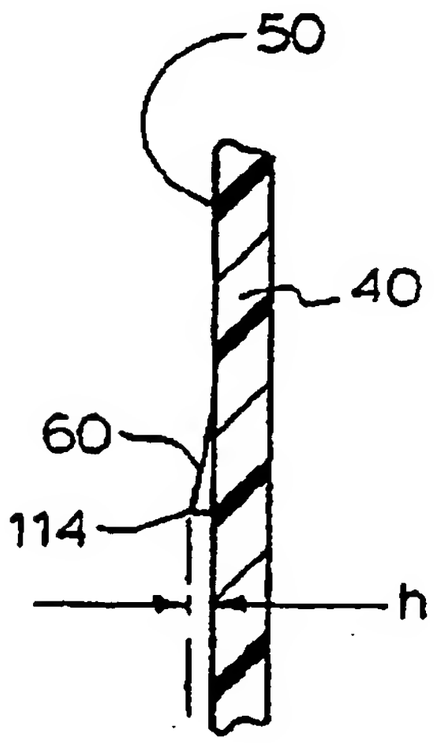


FIG. 3

[Drawing 4]

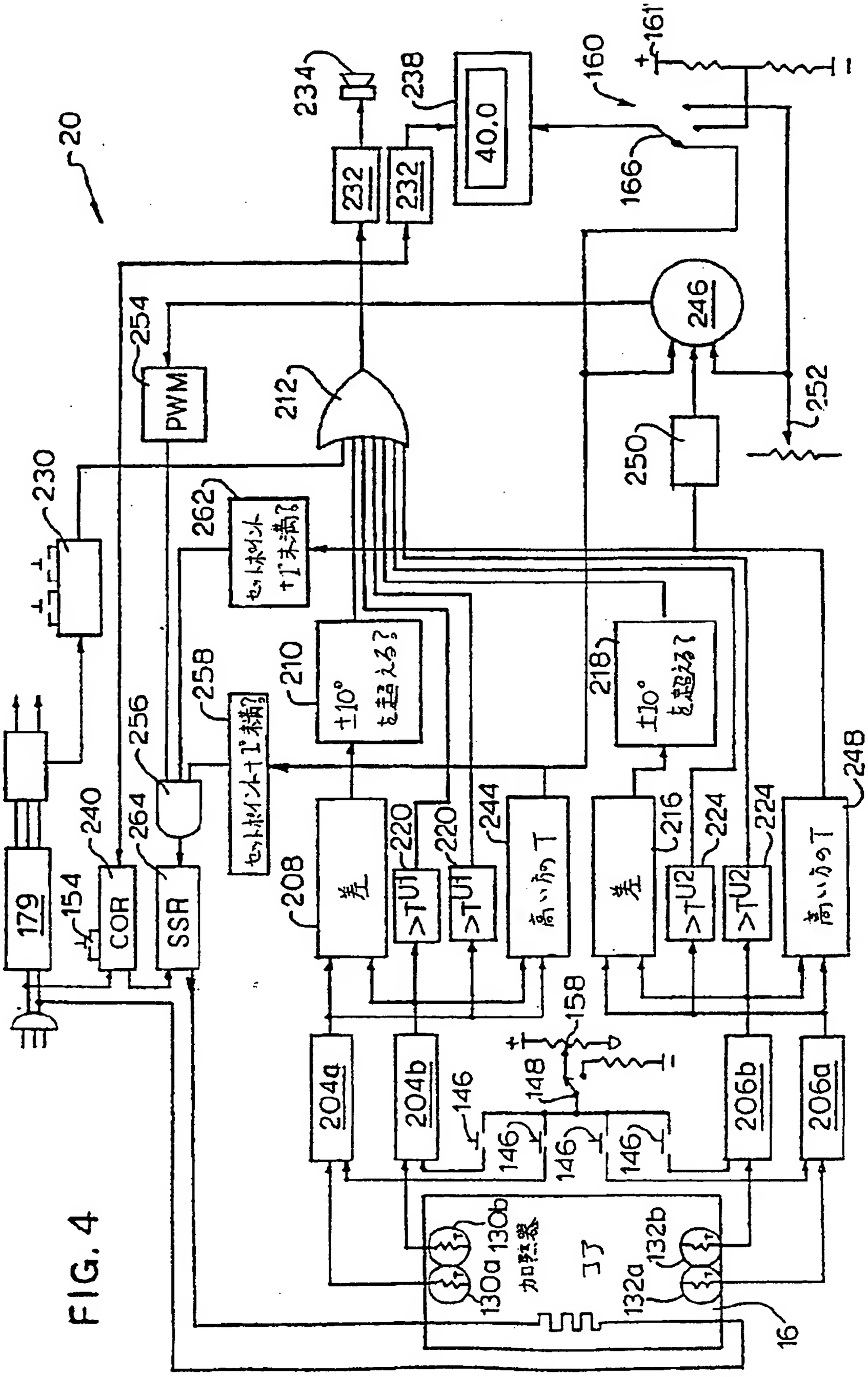
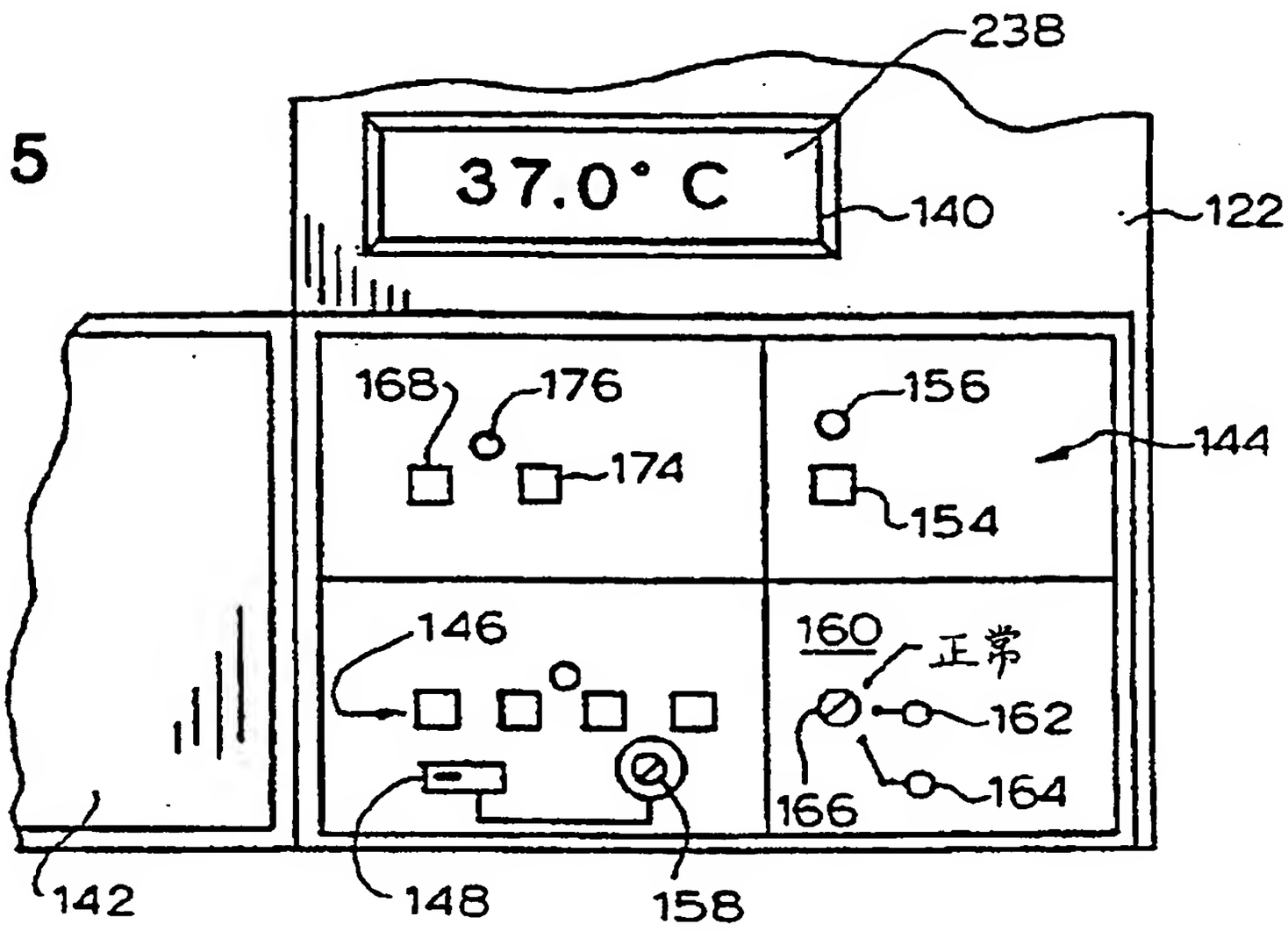


FIG. 4

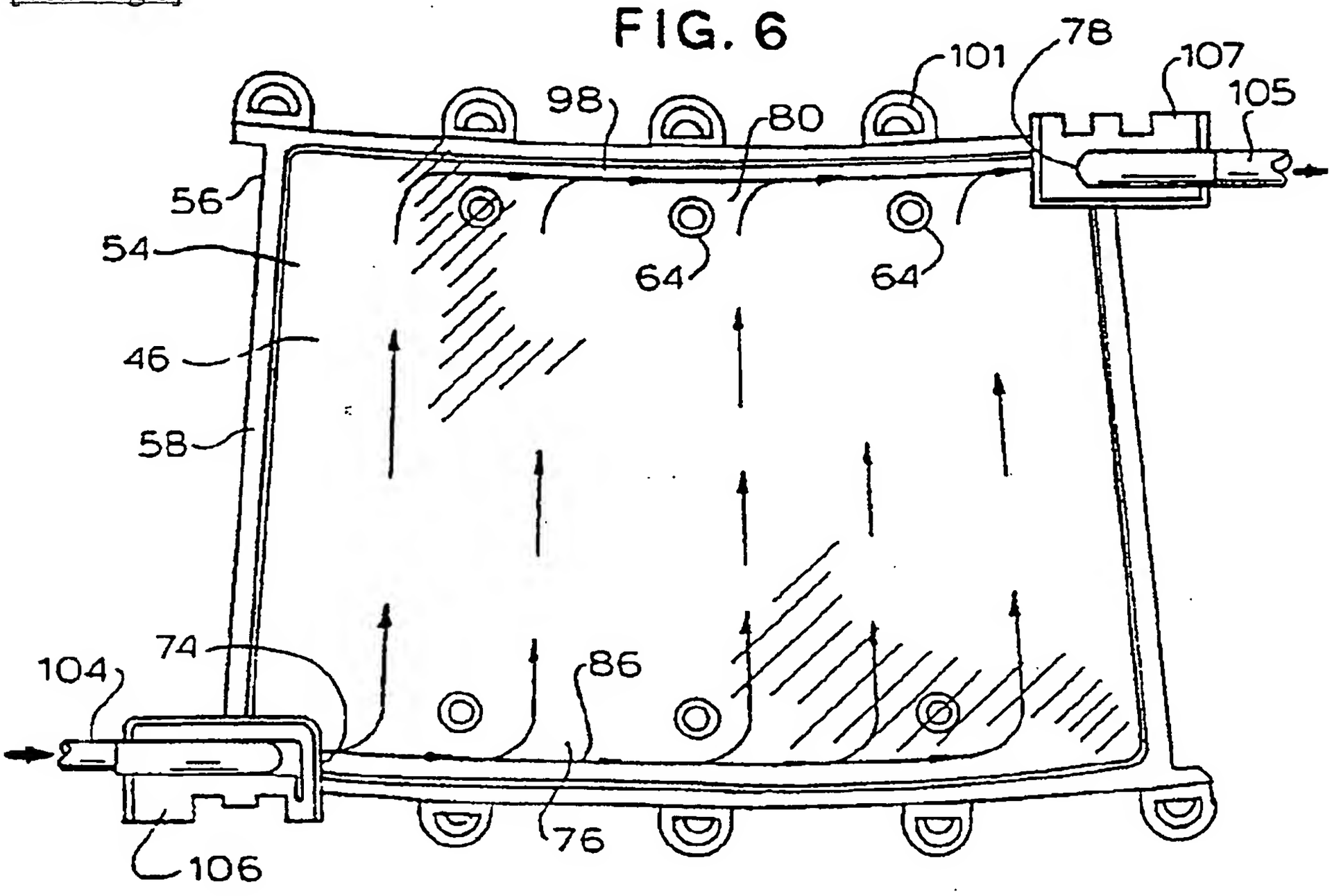
[Drawing 5]

FIG. 5



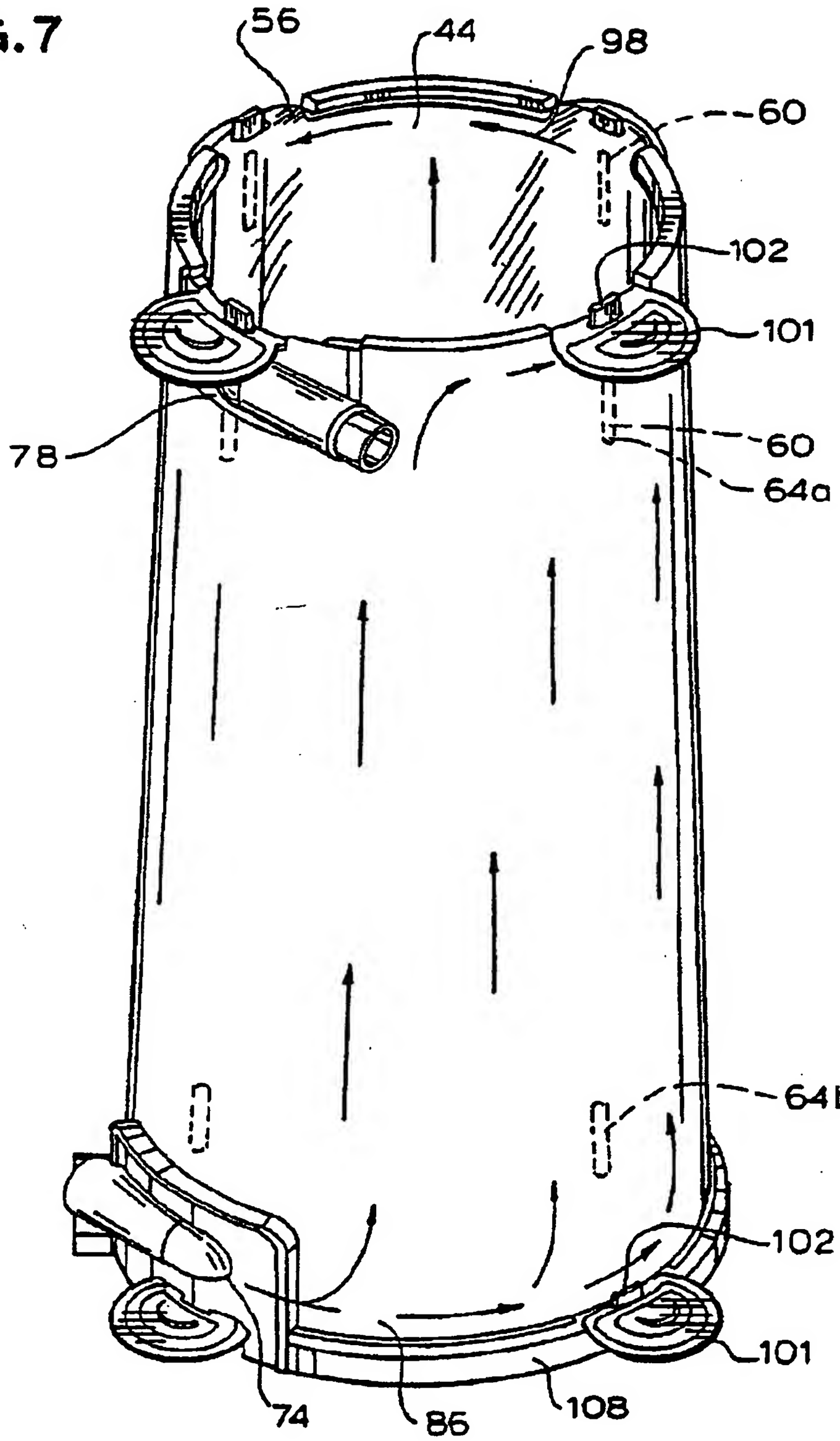
[Drawing 6]

FIG. 6



[Drawing 7]

FIG.7



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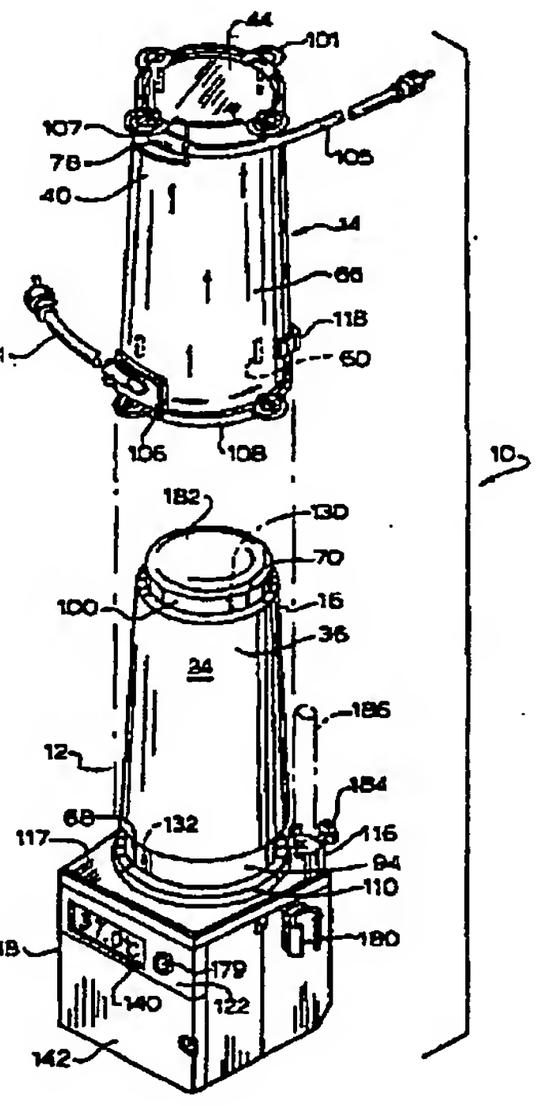
最終頁に続く

(54)【発明の名称】　血液加温装置

(57)【要約】
流体を制御下で加熱する装置(10)の取り外し可能なアセンブリが提供される。装置(10)は、熱伝導性が高い材料により形成される外表面(36)を有するほぼ細長の加熱コア(16)を有し、加熱コアは、アセンブリがコアの長さの少なくとも一部に沿って表面を覆うようにアセンブリ(14)を滑動的に受容するように、円錐台状に成形される。アセンブリ(14)は、コア(16)に沿った上向きのほぼ一方向の制限されないシート状の流れのための密封された通路(46)を形成する。制御システム(20)は、流体が、変動する流速の下で過熱されることなく通路(46)から流出する前に所望の温度に加温されるように、加熱コア(16)を選択的に作動する。

FIG.1



記通路の長さの大部分にわたって締め付け点を形成することなく前記側壁のほぼ均一な間隙を維持するように成形されている、請求項３に記載のアセンブリ。

５．前記制限体が、前記心棒の前記表面領域の大部分にわたって、流体が該心棒の長さに沿って前記入口多岐管から前記通路内のほぼ妨害されないシート状の形状で流れるように成形されている、請求項１に記載のアセンブリ。

６．前記第１の導く手段が、前記入口多岐管への血液の流入を、前記心棒の前記外表面に対して接線方向でありかつ該心棒によって規定される長軸に対してほぼ垂直方向に導くように構成される、請求項１に記載のアセンブリ。

７．前記第１の導く手段が、前記制限体に取り付けられているブラケットを含む、請求項１に記載のアセンブリ。

８．前記内表面がほぼ円錐台の形状である、請求項１に記載のアセンブリ。

９．前記アセンブリが、前記心棒に整合し、かつ該アセンブリを所望の相対位置に配置するように構成される、請求項１に記載のアセンブリ。

10．前記アセンブリが、前記制限体に取り付けられた、前記心棒に整合しかつ所望の相対位置を確保するための手段を含む、請求項１に記載の装置。

11．前記制限体が剛性のシェルを含む、請求項１に記載のアセンブリ。

12．前記アセンブリと前記心棒の前記外表面とが、前記アセンブリが該心棒に対して所望の位置に配置されると、流体が前記通路を通って流れるときに流体の流れが該心棒の表面領域の大部分にわたってほぼ妨害されないシート状の形状を形成するように、該通路を形成するように構成される、請求項１に記載のアセンブリ。

13．前記通路がほぼ一定の厚さである、請求項12に記載のアセンブリ。

14．前記制限体が、前記通路の前記入口および前記出口のほぼ近くに配置されるスタンドオフを形成し、該スタンドオフは、前記心棒に整合し、かつ該通路が該心棒の周りに周方向にほぼ一定の厚さになるように、該心棒に対して所望の角度の位置に該制限体を配置するように構成される、請求項１に記載のアセンブリ。

15．前記心棒が第２の半径方向の溝を規定し、前記制限体と半径方向の溝とが前記通路の出口多岐管部の境界を規定し、前記アセンブリが、該出口多岐管からの

【発明の詳細な説明】

血液加温装置

発明の背景

本発明は、一般に、流体加温装置の一部を形成し、そして装置を通る流体の流れのための密封された通路を提供するアセンブリに関する。より詳しくは、輸血処置などのための制御された温度条件の下で全血のような腸管外流体を加温する装置のためのこのようなアセンブリに関する。

一般に、全血は、血液の質を長期間にわたって保存するために約４℃の温度の冷蔵条件の下で保管される。血液を患者に注入するときは、血液を人間の体温である約37℃に加温して、低体温症状を起こす可能性、ならびにこれに伴う心室細動および心臓の収縮の危険を回避することが必要である。一方で、加温プロセス中に血液の温度を過度に上昇させると、血液は凝固または変敗し得る。

多くの外科処置において、処置中に使用するために加温が必要な血液量は大きく変動し得る。予測される状態すべてに対して十分な血液量を加温する場合、加温された血液のすべてが使用されるとは限らず、この結果、血液は一般に再冷蔵することはできないため、余分の血液が無駄になる。また、事故による犠牲者または他の緊急事態の場合には、輸血のために多量の血液を加温するのに必要な時間が重大な要因となり得る。

多量の血液を加熱するためには、血液は保管アセンブリから患者に流入されるとき加温され得る。しかし、必要な流速は多くの外科的条件および手順により異なる。実際、同じ外科処置中でも、血液の流速は大幅に変動し得る。例えば、処置中に患者が突然出血すれば、患者への血液流を急激に増やさなければならない。出血が止まると、血液流は急激に低下させ得る。

従って、流速が大幅に変動する血液のような流体を制御可能に加温して、流体をほぼ一定の所望の温度で患者に送達するのが可能であることが望ましい。さらに、流体に上限温度がある場合は、流体を過熱および変敗させることなく加熱を行うべきである。

さらに、操作が過度に複雑にならず、かつ流体を所望の出口温度まで正確に加

体加温デバイスを提供することである。さらに、設定は効率的且つ安全に行われることが望ましい。

本発明のさらに別の目的は、加温プロセス中に流体と接触するデバイスのエレメントが使い捨てである、改良された流体加温デバイスを提供することである。

上記の改良された加温デバイスの使い捨てではないエレメントの作動特性と一体化するように構成される使い捨てエレメントを提供することもまた本発明の目的である。これに関連する目的は、上記の改良された加温デバイスの作動特性を劣化させることなく、広範囲にわたって変動する流速に適応し得るこのような使い捨てエレメントを提供することである。

プライミング容量が小さい使い捨てエレメントを提供することも本発明のなおさらなる目的である。これに関連する目的は、使い捨てエレメントを使い捨てではないエレメントに正しく作動可能に取り付けることを容易にすることである。

発明の要旨

従って、流体の流れを加温するための装置の一部を形成するアセンブリが提供される。装置は、広範囲にわたる、または変動する流速に対して流体を制御可能に加温する。好ましくは装置の使い捨てのアセンブリは、この変動する流速に適応する。

装置は、軸を規定するほぼ細長の加熱された心棒を有する加熱基部を含む。心棒の外表面の少なくとも一部は、熱伝導性が高い材料により形成され、かつ滑動的にアセンブリを受容するような形状とされ、これにより、心棒はアセンブリを通って流れる流体を主に伝導によって加熱する。伝導接触は主に心棒とアセンブリとの間で行われる。

アセンブリは外側制限体を含む。制限体にはバッグが取り付けられ、そして制限体の内表面に沿って配備される。バッグは入口および出口を有し、それぞれが接続管に取り付けられる。バッグは好ましくは、互いに接着された一対の側壁を含み、流体が入口と出口との間を流れるようにシート状密封通路を形成する。アセンブリが心棒の周りに配置されると、シート状通路は実質的に心棒の周表面の周りに延びる。

流体加温器の１つの好適な実施態様を、全体として10で示す。加温器10は、全体として12で示す加熱ユニットを含み、加熱ユニットは、取り付けられたアセンブリまたはアセンブリ（全体として14で示す）によって形成される密封流路を通って流れる流体を制御可能に加温する。アセンブリは好ましくは使い捨てかつ取り外し可能である。加熱ユニット12は加熱コア16を有し、加熱コアは、図４に図式的に示される制御システム20の一部を収納する基部18に接続される。

図２も参照して、加熱コア16は、アルミニウムなどのような熱伝導性が高い材料からなる心棒24を有する。シートとして形成され心棒の内表面28と伝導接触する加熱器26により心棒24に熱が供給される。内表面28は、好ましくは、心棒24の高さに延びそして軸34を規定する円筒状空洞部30を形成するように構成される。加熱器は空洞部の高さの少なくとも一部、好ましくは大部分にわたって延びる。

心棒24の外表面36は、使い捨てアセンブリ14を心棒の周りを覆って取り外し可能に配置するのが容易となるように形成される。後述するように、アセンブリ14を心棒24に対して適切に配置することは、加温装置10の最適な性能を得るために重要である。心棒24の外表面36およびアセンブリ14は、相補的に円錐台形状となるように形成される。好ましくは、表面36は垂直基準線43に対して僅かに傾斜を形成するように構成される。

取り付け可能なアセンブリ

アセンブリ14は、外側制限体40と内側バッグまたはカフ44とを含む。内側バッグは、流体が装置10を通って流れている間、ほぼシート状の形状を有する密封通路46（図６）を形成する。通路46は、流体が加温装置10を通って流れるとき加熱ユニット12の熱出力が流体のすべてを上限温度を超えずに所望の温度に加温するように、独特の形状とすることが重要である。

加温装置10のこの好適な実施形態については、加熱コアの周りにほぼ一定の厚さを有するシート状の流れを形成することが非常に望ましい。従って、使い捨てエレメント14と心棒24との間を相対的に正しく位置決めすることが重要である。制限体が心棒24に対して傾いている場合は、通路46のいくつかの部分の厚さが薄

くなり過ぎ、流れが制約され緩速化される恐れがある。同様に、通路の心棒とは

図２および図６を参照して、加圧流体がカフ44を通って流れると、流体はシート54を制限体40および心棒24に対して押しつけ、そして通路46は境界47の形状となる。制限体40を心棒24に対して位置合わせおよび整列させて、心棒24に沿っておよび心棒の周囲に円周状に均一の隙間48を有する通路46を形成するために、一連のスタンドオフ60（図３）が形成されて制限体から内側に延びる。スタンドオフ60は、心棒24の外表面36に接触して、心棒に対して所望の位置でアセンブリを支持する。

特に図７に示すように、スタンドオフ60による通路46の「締め付け」およびシート状の流れの乱れは最小限である。好ましくは、心棒24に沿って外側の通路46の長さの少なくとも一部、そしてより望ましくは半分以上にわたって、カフ44内の通路46の厚さは心棒の周囲に円周状に均一である。また、心棒および制限体40の対向する境界表面には、通路46の長さの実質的な部分、および好ましくは大部分にわたって締め付けを行う障害物は全くない。従って、通路46を通って流れる流体は、心棒24の外表面領域の大部分にわたってほぼシート状の形状で流れる。

この好適な実施形態では、カフ44はスタンドオフ60の上に延びる。スタンドオフ60と心棒24とが接触するとカフ44が損傷し得ることが予想される。従って、カフ44は、スタンドオフ60と整列する補強窪み64を形成する。窪み64は、窪みの部分でカフ44の摩耗または穿孔が生じても通路46が破裂しないように形成される。窪み64は、好ましくは、シート54を合わせて溶融してスタンドオフ60との接触点の周りに保護シールを形成することにより形成される。

制限体40は、変動する圧力および流速条件の下で通路46を流れる流体により通路の厚さが実質的に変動しないようにカフ44を支持し得ることが重要である。さらに、制限体40はカフ44を保護しなければならない。従って、この好適な実施形態では、制限体40は、好ましくは、軽量の剛性シェル66である。また、保管スペースを減らすために、シェル66は曲げやすく柔軟性であるようにすることも考慮される。カフ44の側壁の一方が制限体40を形成し得ることもまた考えられる。

通路46に流れる流体は、先ず心棒24の基部68の周りを流れ、次に表面36に沿って心棒の上端70までシート形状内を上向きに流れるように導かれる。流体の入口74はカフ44の下端部76に形成され、そして出口78は上端部80に形成される。

をなしかつ整列された方向に導く。シート54の周辺縁56は管104のあたりで密封状態で互いに接着される。応力を解放し、管104を制限体40に固定し且つこれに向けるために、アセンブリ14は制限体に接続するブラケット106を含む。ブラケット106はまた、所望の方向で制限体40を通り隙間48へと至る管104の通路を提供する。

出口78は、出口多岐管98と整列している出口管105に接続され、多岐管98に沿って流れる流体はこの管に導かれる。シート54の周辺縁56は、管105のあたりで互いに密封状態で接着される。応力を解放し、管105を制限体40に固定し且つこれに向けるために、アセンブリ14は制限体に接続する上部ブラケット107を含む。ブラケット107はまた、所望の方向で制限体40を通り隙間48へと至る管104の通路を提供する。

カフ44は、タブ102（制限体40の縁に沿ってまたは縁に隣接して形成される）に取り付けられ、そしてカフを内表面50に沿って層状形状に維持する一連の外側耳部101と共に形成され得る。

アセンブリ14が心棒24に配置され、そして加圧流体が通路46を通って流れると、心棒およびアセンブリには対抗する水圧の力がシート54によって加えられる。制限体40の水平方向の断面はほぼ円形であるため、制限体に加えられる力はほぼ半径方向に外向きであり、そして心棒24の周囲に沿って等しく均衡が保たれる。次に制限体40の輪の強さにより、加熱ユニット12と使い捨てアセンブリ14との間に締め付けメカニズムまたは補強接続点を必要とせずに、上記の力がうち消される。

互いに反対方向の水圧の力により、カフ44の側壁54が押されて心棒24と接触し、これによりカフ44と心棒との間に良好な伝導接触が確立される。

また、アセンブリ14の心棒24に対する適切な配置を容易にするために、シェル44に下部エプロン108を形成し、心棒24の半径方向のボス110と隣接することにより接触させて、そしてシェルと心棒とを垂直方向に整列させる。原理的にはスタンドオフ60がアセンブリ14を基部18に対して整列させると考えられるが、エプロン108とボス110とが下縁で接触することにより、ユーザが不注意にアセンブリを心棒24に詰まらせるのを防ぐ働きをする。

されるように構成される。各バンドは均一の熱出力密度であり、そしてバンドの

熱出力密度は所望の割合だけ互いに異なる。コア16の下端に沿って配置される下部横方向バンド124aは、上端の上部横方向バンド124bより出力が大きく、中間のバンド124c～124eでは熱出力が次第に大きくなる。

加熱シート26は、上部バンド124bの熱出力密度が下部バンド124aの熱出力密度の約20％であるように構成され得る。下部バンドの約75％の熱出力密度を有する下部中間バンド124c、下部バンド124aの約50％の熱出力密度を有する中間バンド124d、および下部バンドの約30％の熱出力密度を有する中間バンド124eを形成することにより、良好な結果が生じることが分かった。また、他の熱出力分布を有する加熱コア16を提供しても十分な結果が生じ得ることも予想される。

また図４を参照して、流体の加熱を制御し得るように流体の温度を感知するために、装置10は、心棒24の上端に極めて近い位置に配置される、少なくとも１つ、好ましくは複数の温度感知デバイス130を含む。また、装置10は、心棒24の下端に極めて近い位置に配置される少なくとも１つ、および複数の温度感知デバイス132を含む。好ましくは、デバイス130および132は、心棒24の各端に配置される。良好な温度感知範囲および安全性を提供するために、上部および下部感知デバイス130、132は共に、好ましくは、２つの個別の温度感知デバイスを含み、そのペアのデバイスそれぞれが心棒24の反対側すなわち180°離れて配置される。また、下部デバイス132は上部デバイス130と垂直方向に整列されるのが好適である。安全かつ信頼性のあるシステムを提供するためには、温度感知デバイス130および132はサーミスターである。他のタイプの温度感知デバイスもまた用いられ得る。

制御システム

図４を参照して、制御システム20は特に、流速が広範囲に変動する条件下で流体が使い捨てアセンブリ14（図１）を通って流れるときに、流体を過熱せずに所望の温度に安全に加熱するように、加熱コア16の作動を制御するのに適している。典型的には、システム20への入力は、上部温度感知デバイス130aおよび130b、ならびに下部温度感知デバイス132aおよび132bからの信号出力である。上部温度

を上限温度T^{U1}と比較する。第３比較回路220の一方が、感知された入力温度が上限アラーム温度T^{U1}より大きいと決定すると、この回路から第３アラーム信号がORスイッチ212に出力される。加温されている流体が血液などの場合は、T^{U1}は好ましくは42°である。

同様に、下部感知デバイス132aおよび132bのそれぞれからの第２増幅出力が対応する個別の第４比較回路224に供給される。第４比較回路224は、入力信号を予め決定したアラーム温度T^{U2}と比較する。T^{U2}は好ましくはT^{U1}に等しい。回路２２４の一方が、感知されている高い方の温度がT^{U2}に少なくとも等しいかまたはこれより高いと決定すると、この回路は第４アラーム信号をORスイッチ212に出力する。

従って、制御システム20は、温度感知デバイスによって供給される表示された温度を使用して、上部感知デバイス130aおよび130bの一方が不適切に作動しているかどうか、ならびに下部感知デバイス132aおよび132bの一方が不適切に作動しているかどうかを決定し、そして感知デバイスが適切に作動していないと決定するとアラーム信号を生成することが分かり得る。また、制御システム20は、上部感知デバイス130aおよび130bのいずれか一方、または下部感知デバイス132aおよび132bのいずれか一方が、それぞれの予め決定したアラーム温度に少なくとも等しいかまたはこれより高い温度を感知しているかどうかを決定し、そしてアラーム温度に等しいかまたはこれを超える場合はアラーム信号を生成する。

制御システム20はまた、加熱シート26に供給されている電力を監視する電圧モニタ回路230、および制御システムを構成する構成エレメントを含む。電圧モニタ230は、故障状態が決定されると、第５アラーム信号をORスイッチ212に出力する。

ORスイッチ212が、回路210、回路218、回路220、回路224、または回路230からそれぞれ第１、第２、第３、第４、または第５アラーム信号を受けると、信号がアラーム回路232に伝送される。アラーム回路232の一方は、健康管理提供者に故障状態であることを知らせる少なくとも１つの可聴アラーム234を活性化させる。第２のアラーム回路232は、バックライトまたは表示パネル238の数字を点滅さ

れていなければ、流速が突然変化しても、上部センサ130が上端70の温度の変化を検出するまでは加熱ユニット12の熱出力は変動しない。

例えば、一定の熱供給を維持しているとき血液の流速が突然上昇すると、装置10を出てくる血液の温度は低下する。後述するように、次にユニット12の熱出力が増加する可能性があるが、この増加は、カフ44の出口またはその近くの血液を所望の温度に加温するのに時間的に間に合うとも、または十分であるとも思われない。従って、流速の変化を可能な限り速く、かつ、この好適な実施形態では入口74に極めて近い位置で感知するのが望ましい。

この好適な実施形態では、流速の変化は、流体が最初にカフ44に流入する通路46の下端76に極めて近い位置で心棒24の温度の変化を監視することによって検出され得る。加熱ユニット12が比較的一定の熱出力を提供し、そして流入流体が低温である場合、流体の流れの実質的な変化は、概して、下部温度感知デバイス132aおよび132bによって感知される心棒24の下端の温度の変化に反映される。例えば、通路46への流体の流れが実質的に増加することにより、概して、心棒の下端がかなり急速に冷却される。従って、加熱コア16の熱出力を増加させるべきである。反対に、通路46への流体の流れが実質的に低下すると、概して、心棒24の下端がかなり急速に加熱される。従って、加熱コア16の熱出力を減少させるべきである。

回路224を増幅する下部温度センサのそれぞれからの出力は、第６比較回路248に供給される。第６比較回路248からの出力は、下部温度感知デバイス132aおよび132bによって感知されている高い方の温度を表し、そして演算比較回路246への第２入力を生成する微分回路250に供給される。微分回路250によって生成される第２入力は、下部温度感知デバイス1gl32aおよび132bによって感知されている温度の変化の割合に少なくとも部分的に依存して変動する。

演算回路246は、微分回路250、および感知された温度とセットポイント温度T_{SP}との間の平均差異に基づく電力決定からの入力を合算し、そして信号を電力調整回路254に出力する。好ましくは、電力調整回路254はパルス幅変調器などであるが、他の適切な調整回路も意図される。電力調整回路254からの出力は、接合

しかし、セットポイント比較回路258、262のいずれかからの出力が、電力調整出力254からの出力に優先し、このためスイッチ回路264が加熱器26への電力を遮断する。感知される最高温度がトリガー温度T^{T1}、T^{T2}の両方より低くなると、電力調整回路254の制御が回復する。

この好適な実施形態では、加温器10の制御ロジックは回路エレメントの新規の構成を用いることによって達成されるが、加熱器26の出力を制御して流体を制御可能に加熱する他の方法もまた意図される。マイクロプロセッサおよび適切なプログラミングを用いることによって制御を実現することもまた構想される。このようなプログラミングは、揮発性または非揮発性のメモリもしくは多種類のメモリの組み合わせで配置され得る。さらに、プログラムの一部を異なるメモリユニットに格納し、これらのいくつかを取り外し可能にして、遠隔操作でプログラミングするか、または異なる流体のために、加温器10の作動特性を容易に構成し得るようにしてもよい。

制御パネル

図１および図２を参照して、基部18はほぼ立方体の形状に形成される。基部18の前面122は、ディスプレイ238を見ることのできるビュー開口部140を形成する。ラッチドア142が基部18の一部を形成し、そしてヒンジによって前面140に取り付けられる。図４と関連させて図５を参照すると、ラッチドア142は、全体として参照番号144で示される制御パネルの保護用カバーを提供する。制御パネル144は、技術者が装置10の制御システム20についての試験を行うための簡単な手段を提供する。制御パネルには、上部温度センサ130aおよび130b、ならびに下部温度センサ132aおよび132bのための試験を行うボタンスイッチ146が含まれる。ボタンスイッチ146に関連して、複数の試験条件のうちの１つを選択的に選ぶスイッチ148が配置される。ボタンスイッチ146のうちの１つを押すことによって、それぞれの温度感知デバイスにシミュレートされた故障状態が生成され、そしてこの結果、アラーム回路232を始動させる（すなわちアラーム状態となる）。さらに、ライト150が点灯して、ボタンスイッチ146が押されたことを示す。

特定の試験条件はスイッチ148の位置に依存する。第１の位置では、ボタンス

いずれももはや点灯しない。

制御パネル144はまた、制御回路の試験に関連するスイッチ168、および下部センサライト170の変化の割合に依存して熱出力を調整する回路を試験するためのスイッチ174を含む。これらのスイッチ168、174のいずれかを押すことにより、対応するライト176もまた点灯し、アラーム回路232が活性化し、そして遮断中継器240が遮断される。リセットスイッチ154を押すことによって、アラーム232および遮断中継器240はリセットされ、そして点灯しているライト176は消灯され得る。

つまり、種々のアラーム条件および視覚ディスプレイが、試験スイッチを利用することによって技術者によってチェックされ得る。各試験を行うと、対応する表示ライトが点灯する。従って、すべての試験が完了し、そして回路が適切にリセットされると、すべてのライトが消灯する。

試験が完了すると、ドア142が閉鎖されそしてロックされて、装置10の後のユーザが接触するのを防止する。装置10の適切な作動を確実に得るための一助として、後のユーザはオンオフスイッチ179（図１）に限定される。後の使用で「不法妨害」アラーム条件が発生する場合は、制御システム20は、オンオフスイッチ179で装置10をオフにし次にオンに戻すことによってリセットされ得る。このような操作の後もアラーム表示が続く場合は、装置10が機能不全であることを示していると考えられる。

図１に戻って、この好適な実施形態での基部18はまた、血液などを患者に投与している間に通常使用されるバブルトラップ（図示せず）を保持するための摩擦フィットホルダー180を含む。装置10はまた、環境保護のために加熱コア16の先端周りにはめ込まれるカバー182を含む。

据え付けについては、装置10は、基部18に取り付けられたクランプ184を含む。クランプは装置をロッド186に締め付ける。クランプ180はまた、装置10をロッド186から容易に取り外し可能にする。ロッド186は、通常は垂直方向に配置されるが、装置10の作動特性により、装置はいかなる方向でも作動し得る。

作動の際、アセンブリ14は、スタンドオフ60が心棒24の外表面36に接触するま

次に加熱された流体は出口多岐管98に集められ、そして多岐管の長さ方向と整列されかつ心棒24の表面36に対してほぼ接線方向に出口管105を介して多岐管から出ていく。

上部管80がバブルトラップ（図示せず）を含む投与セットに接続される場合は、バブルトラップはクランプ180に取り付けられ得る。

医療処置が加温血液をもはや必要としない時点に達すると、加熱ユニット12は遮断され、次に、耳部118がクランプ116内に形成されたノッチ120の下部から外れるまで、アセンブリ14を加熱ユニット12に対して回転させる。次にアセンブリ14を心棒24から上方向に滑動的に取り外し、そして適切な方法で処分し得る。

上記の作動についての記述から分かり得るように、加温装置10の設定および作動はかなり単純であり、そして作動の管理量は少ない。一般には、設定は、使い捨てアセンブリ14を加熱ユニット12の上に滑動的に、かちっとはめ込むことを含む。オンオフスイッチ179を押すことにより、アセンブリ10が活性化される。管理は、アラームを観察すること、および表示温度を監視することを含む。

血液加温装置の特定の実施形態を図示および記述したが、その幅広い局面においておよび以下の請求の範囲に示すように、本発明から逸脱することなく変更および改変が行われ得ることは、当業者によって理解され得る。

【図１】

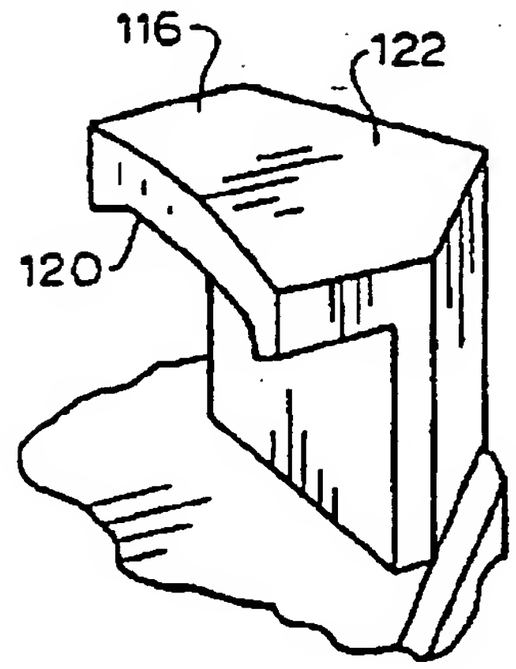


FIG.1a

【図３】

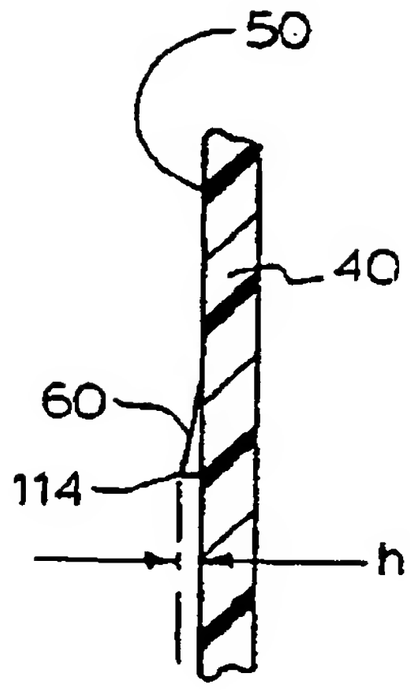
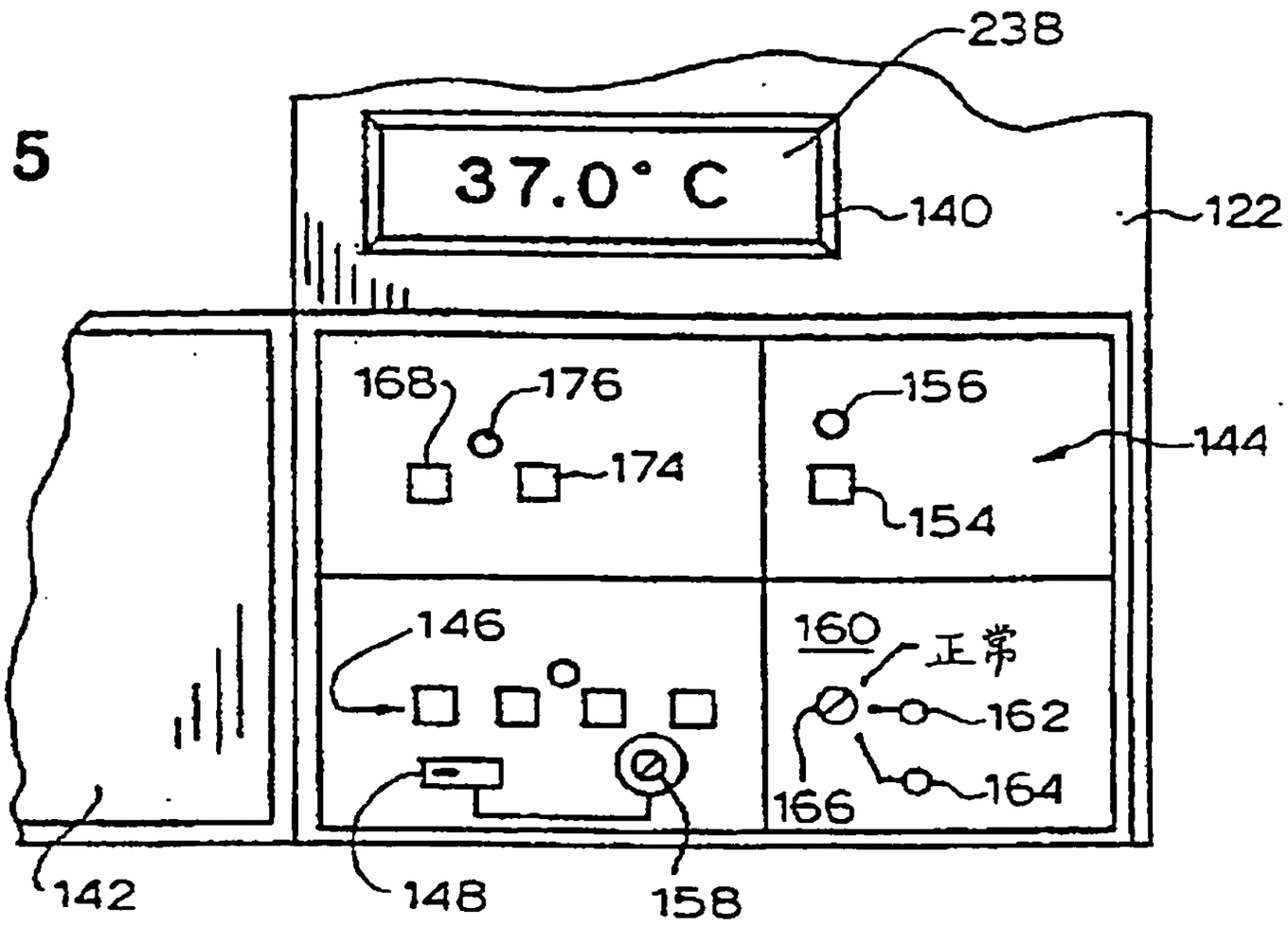


FIG. 3

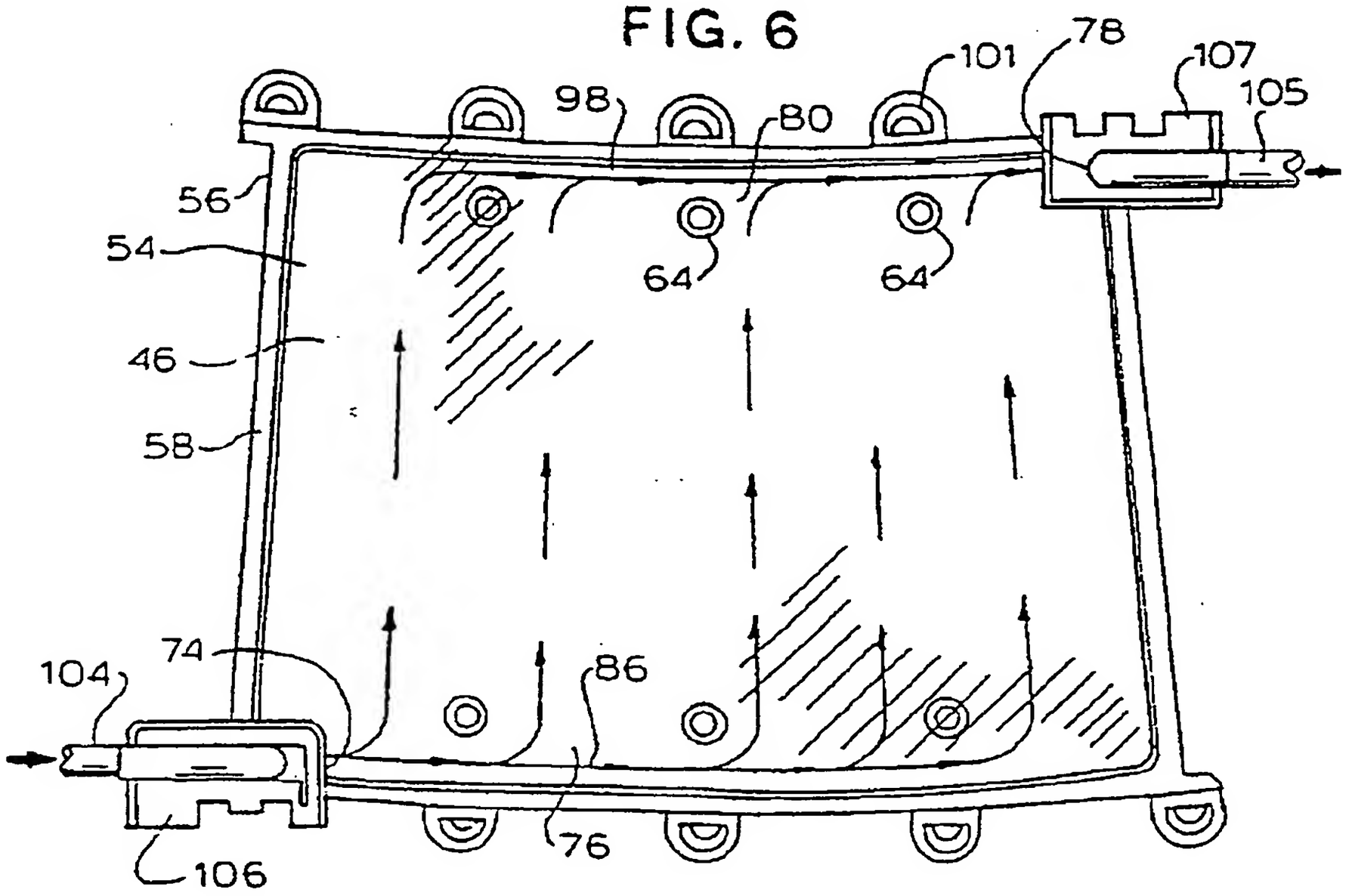
【図５】

FIG. 5



【図６】

FIG. 6



【国際調査報告】

INTERNATIONAL SEARCH REPORT

Inte onal Application No
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A. CLASSIFICATION OF SUBJECT MATTER
IPC 6 F24H1/12 A61M5/44

According to international Patent Classification (IPC) or to both national classification and IPC

B. FIELDS SEARCHED

Minimum documentation searched (classification system followed by classification symbols)
IPC 6 F24H A61M

Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched

Electronic data base consulted during the international search (name of data base and, where practical, search terms used)

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category *	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
X	US 3 443 060 A (SMITH EDWARD M) 6 May 1969 see the whole document	1,2,5, 8-14
X	WO 93 02722 A (WILES TERRY L) 18 February 1993 see the whole document	1,5-11, 20
X	US 3 096 426 A (AXELSON) 2 July 1963 see column 2, line 12 - line 19; figures	1,5,8
A	US 4 464 563 A (JEWETT WARREN R) 7 August 1984 see the whole document	1-20
A	US 4 019 020 A (BILBEE LARRY T ET AL) 19 April 1977 see the whole document	1-20

☐ Further documents are listed in the continuation of box C.

☒ Patent family members are listed in annex.

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